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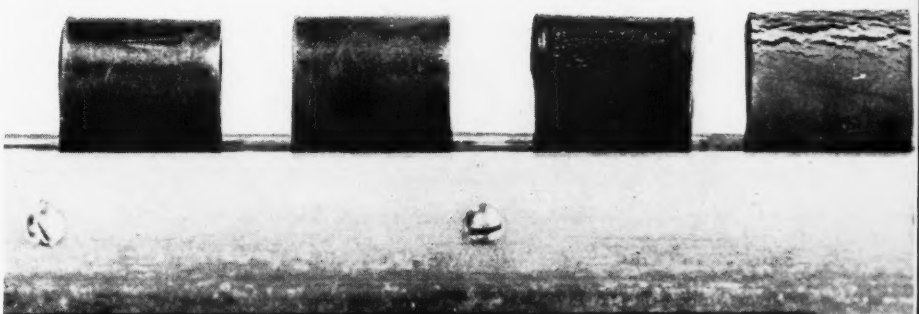
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RESISTANCE OF RUBBER COMPOUNDS TO OUTDOOR AND ACCELERATED OZONE ATTACK–Page 699

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INDUSTRY HELP NEEDED WITH GOVERNMENT S.I.C.'S
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RESISTANCE OF RUBBER COMPOUNDS TO OUTDOOR AND ACCELERATED OZONE ATTACK
C. V. Lundberg, G. N. Vacca, and B. S. Biggs 699

Observations on ozone cracking of natural and several synthetic rubber compounds exposed statically outdoors and in ozone chambers have been correlated, and the effectiveness of waxes, antiozonants, and higher-than-normal concentrations of antioxidants has been determined.

THE DETERMINATION OF OIL AND STABILIZER IN OIL-MASTERBATCHED POLYMERS
Dorothy C. Prem, T. B. Larchar, Sr., N. S. Trommer, R. M. Clibourn 714

A procedure for the simultaneous determination by ultra-violet spectrophotometry of oil and stabilizer in oil-master batched styrene-butadiene rubber is outlined.

NBS ADDS SBR 1000 AND 1500 TO STANDARD SAMPLES 721

A hot and a cold styrene-butadiene rubber standard rubber sample have been added to the reference materials for rubber compounding by the National Bureau of Standards.

SOUTHERN RUBBER GROUP PANEL DISCUSSION ON "COMPOUND DESIGN" 723

Talks on accelerators, antioxidants, fillers, plasticizers, etc., and the questions and answers are included in the transcript of this panel discussion.

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News about

B.F.Goodrich Chemical *raw materials*

★ new high-tack Hycar

★ specification compounding

★ liquid GR-S polymer



One of the new applications *of Hycar American Rubber is for the liner sections of a centrifugal separator. Here Hycar withstands an abrasive stream of sand and mud, plus entrained oil and gas.*

NEW HIGH TACK HYCAR COMPOUND FOR SPECIAL USES. Hycar 1042 has recently been developed for applications requiring a high building tack—drum and tank linings, roll building, hose fabrication, etc. The improved tack is a result of the combined action of Plasticizer KP-555 and Hycar 1312, a liquid nitrile polymer. Hycar 1312 also improves knitting of stocks during molding and curing. A filler with a long needle-like structure (Pyrax A) inhibits blistering by allowing the escape of air during the calendering operation.

Compounding is not critical, and ingredients can be modified within fairly flexible limits to obtain physical properties desired for the application. The following recipe is recommended as a basic formulation for high tack compounds:

Hycar 1042	100.0
HBS Zinc oxide	5.0
Sulfur	2.5
FEF Black	40.0
Pyrax A	20.0
Hycar 1312	20.0
KP-555	20.0
TMTM	0.6
NBS Stearic acid	1.0
	209.1

Note: Compound possessed very good tack.

SPECIFICATION COMPOUNDING TO MEET DIFFICULT PRODUCT REQUIREMENTS. Despite the fact that the Hycar nitrile rubber family includes a broad range of types, requests for specialized properties are continually received. This is where our Product Application Laboratory steps in to develop and evaluate specialized compounds. Two recent such developments are of interest:

A low-swell, oil-resisting compound was requested for an accumulator bladder for hydraulic pressure systems. It was essential that tensile strength and elongation would be retained after oven aging, since the bladder is subjected to heat and alternate increase and release of pressure. Two compounds proved satisfactory, one based on Hycar 1042, the other based on Hycar 1002.

A compound that maintained properties upon immersion in fuel was requested for a gasket application. A compound based on Hycar 1041 and 1042 showed a volume swell of only 1%, and no change in hardness, after immersion for 60 days in Reference Fuel B, followed by 30 days drying.

LIQUID GR-S POLYMER LOWERS VISCOSITY OF STANDARD GR-S. Ten to fifteen parts of Hycar 2000X68, a liquid GR-S polymer now in production, can be substituted for an equivalent amount of standard GR-S to lower the Mooney viscosity of the mixture to that of GR-S 1010. Since the latter is premium priced and difficult to manufacture, the liquid polymer should be useful and economical in many applications.

Another use where the liquid polymer can prove valuable is in substituting for part of the Hycar in recipes to improve processing characteristics, in compounds where high hardness is desired in the cured state.

For further information on Hycar nitrile rubber, write Dept. ES-2, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ont.

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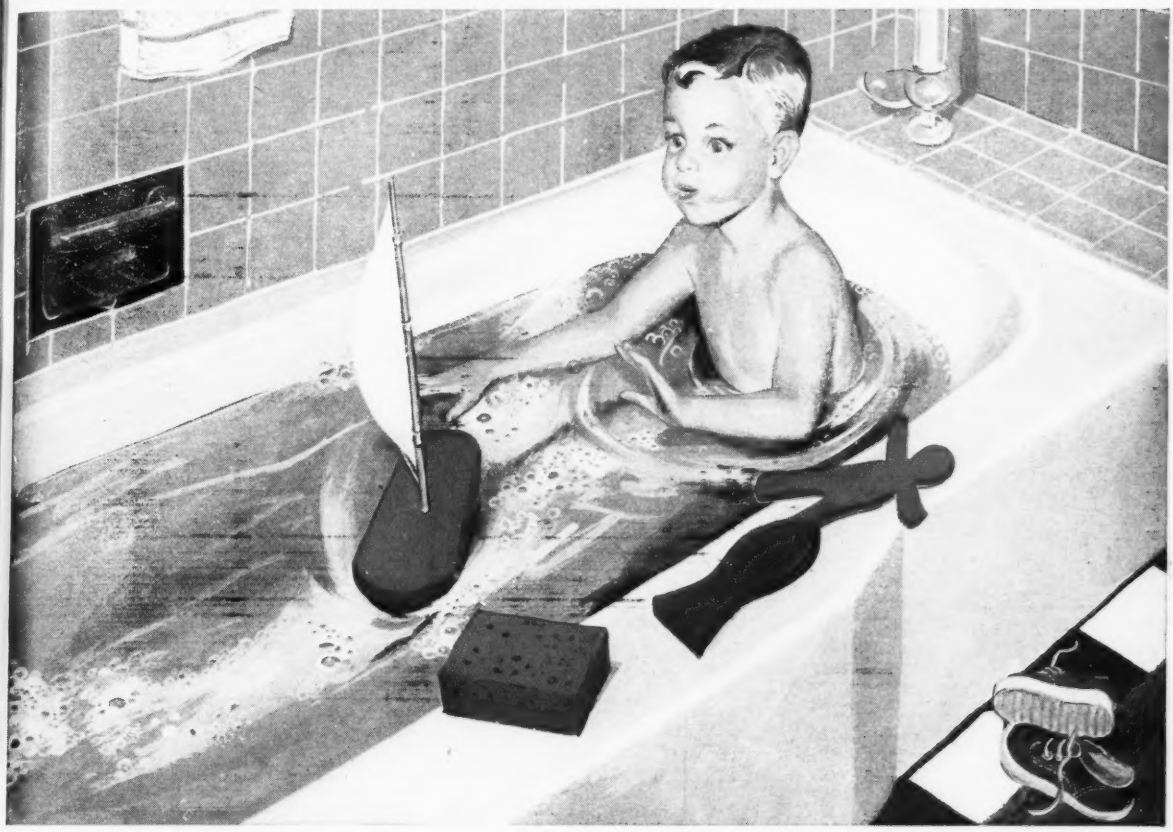
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CELOGEN® – Starts decomposing slowly at 130° C. (266° F.) and reaches maximum gas evolution at 150°-160° C. (302°-320° F.) therefore should be added to batch during mill warm-up.

CELOGEN-AZ – Decomposition temperature range in air is 195° C. (383° F.) minimum, making practical its addition during Banbury mixing. The use of various "promotors" permits material lowering of decomposition temperature. Celogen-AZ does not support combustion.

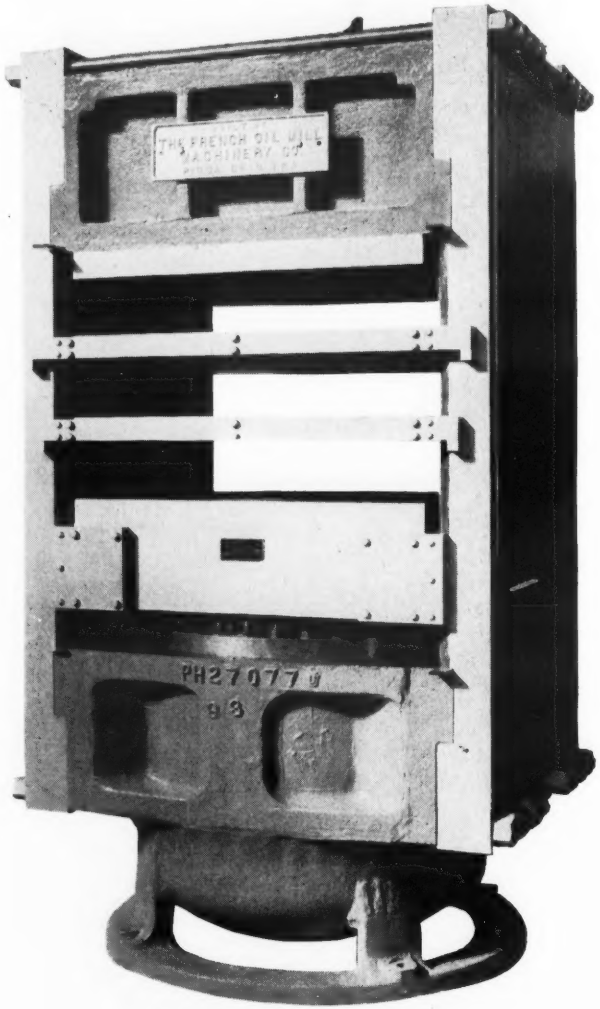
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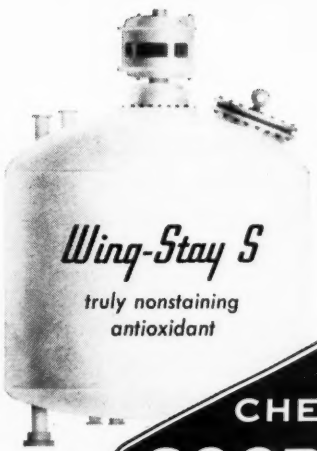
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Photo courtesy Certified Creations, Inc., New York, N. Y.

Here's the key to colorful foamed rubber



Being cellular makes foamed rubber difficult to protect from oxidation. Some staining antioxidants are effective, but of little value since most uses for foam rubber require bright, clean colors.

Take the distinctively colored, snug-fitting, washable coasters pictured above. They would quickly lose their appeal and utility if they discolored or were inadequately protected. But they won't, thanks to WING-STAY S, the truly nonstaining antioxidant.

WING-STAY S is a liquid phenol-styrene derivative which is not extracted by water in foam latex and is nonvolatile in the large surface area of foam rubber. It is highly resistant to heat, sunlight and age—protects without odor, migration or discoloration.

Full details on WING-STAY S plus the latest-Tech Book Bulletins are yours by writing to: Goodyear, Chemical Division, Akron 16, Ohio.

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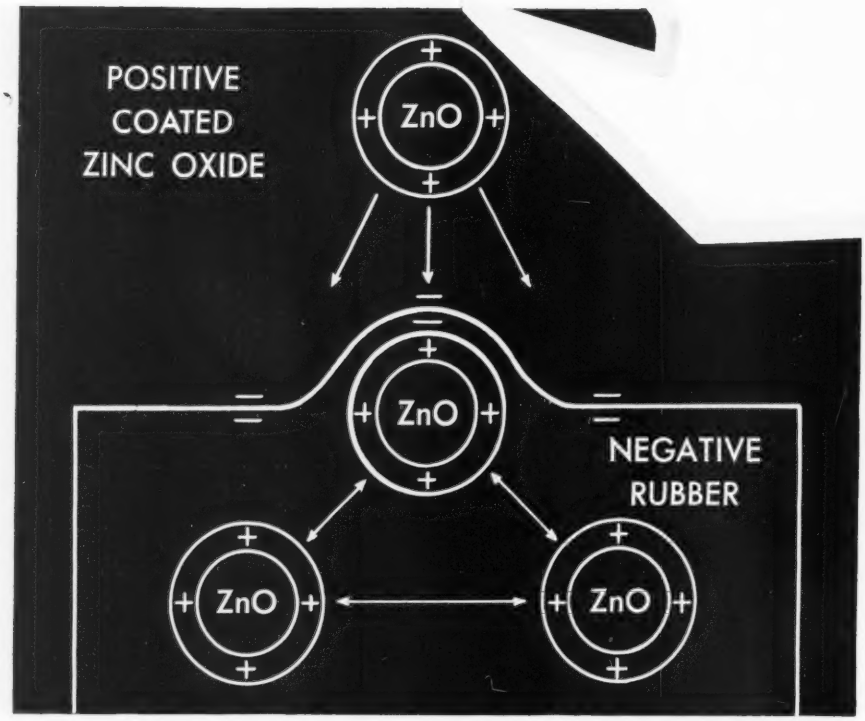
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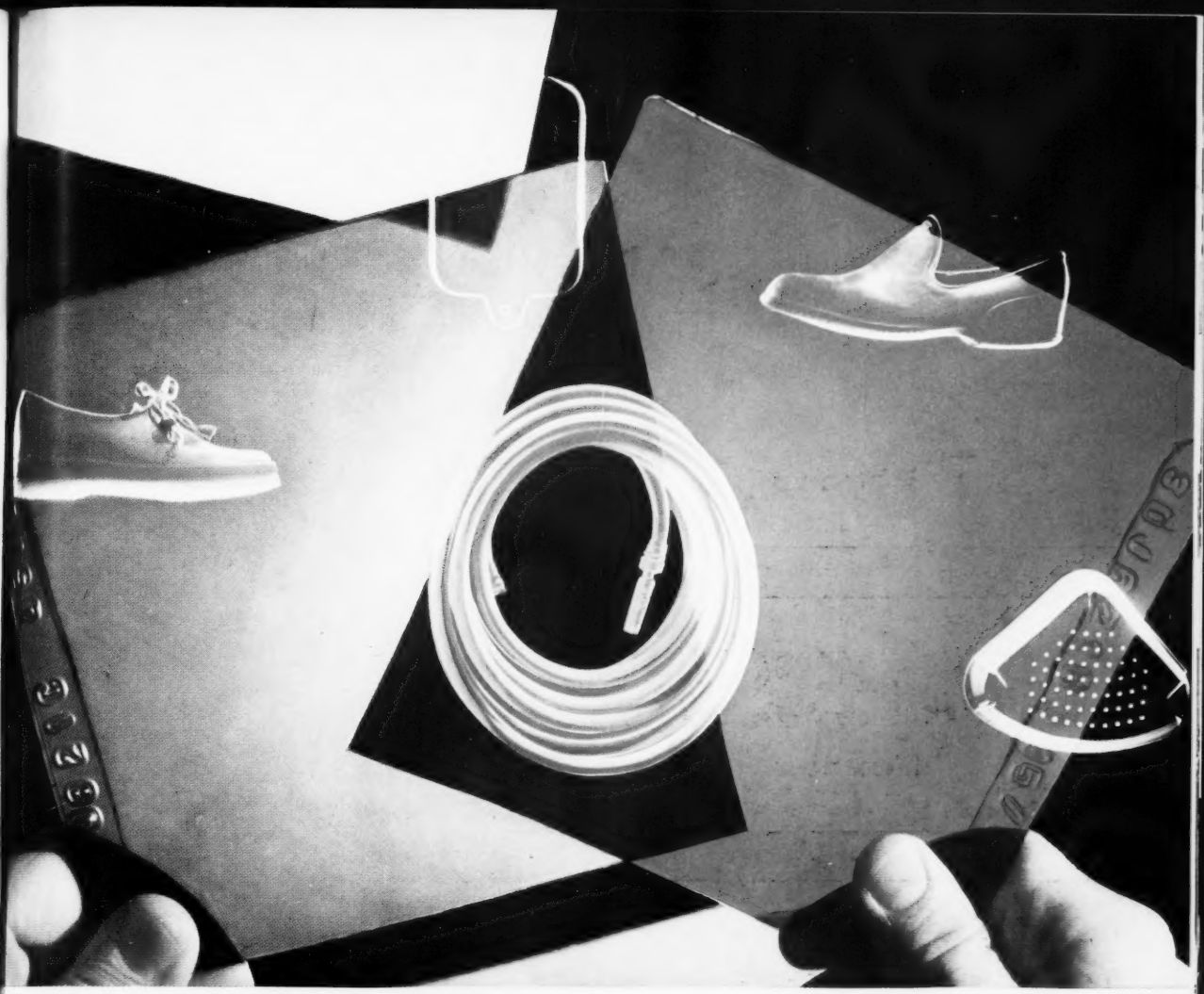
Added values include:

greater moisture resistance, lower Mooney plasticity, lower permissible mixing temperature, increased mixing capacity, lower power consumption and lower power peak.

If you are not now using St. Joe *Coated* Zinc Oxide, why not order enough to make a good pilot plant test? Or better yet production test? This is the best way to prove to yourself that this grade of oxide would be best for your production and end-product.

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What new use for synthetic rubber do you see here?

Clearly different is the sample of compounded PLIOFLEX—the lighter colored synthetic rubber—pictured above. It's the first time ever that such clarity has been achieved in rubber. And what a host of possible uses it brings to mind—shoe soles, hose, tubing, toys, housewares, novelties.

Easier said than done, however, was finding the right combination of materials to produce this "clear" compound. Over 700 formulations were evaluated before success was realized. And of all the rubbers and pigments tested only combinations of PLIOFLEX 1778 and a silica pigment, Hi-Sil 233, permitted the maximum clarity for both hard and soft products.

The reasons why PLIOFLEX fills the bill so well are its extremely light color, its purity and its excellent general physical properties, not to mention its economy. These, incidentally, are the same reasons why PLIOFLEX is so frequently specified for other, more common uses.

What can you do with PLIOFLEX in "clear" rubber or other applications? Start finding out by writing for full details to: Goodyear, Chemical Division, Dept. B-9418, Akron 16, Ohio.



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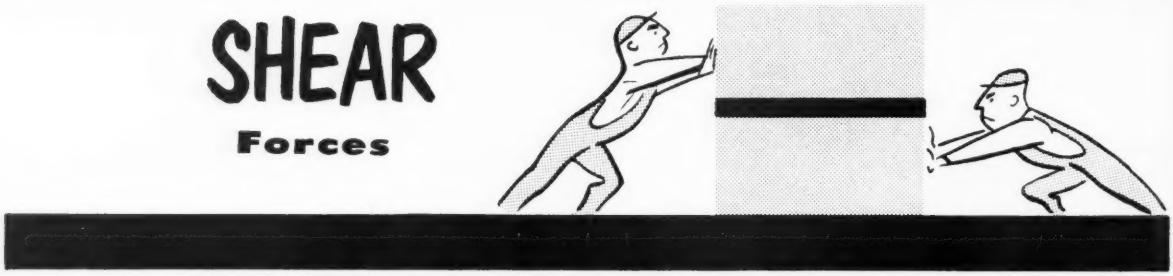
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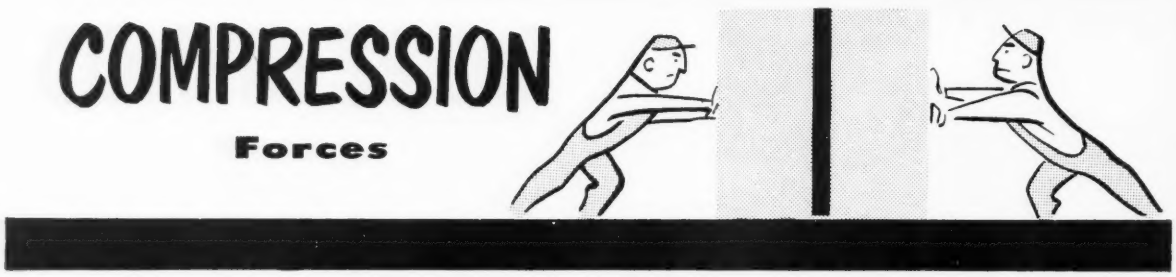
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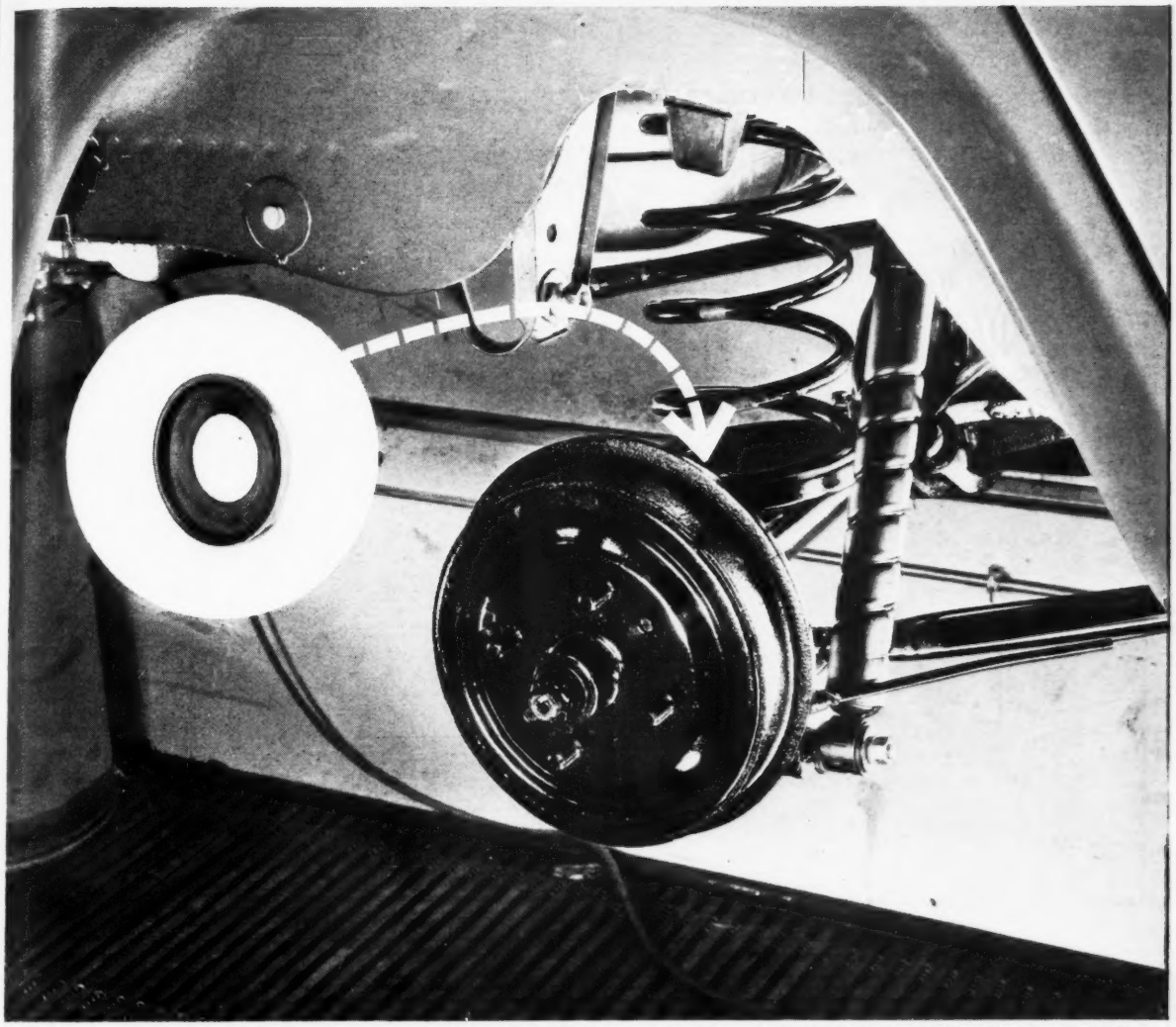


Photo courtesy American Motors Corporation, Detroit, Mich., and Yale Rubber Mfg. Co., Sandusky, Mich.

How to make "sealability" mean salability

If you're interested in making oil seals that will sell, then take two tips from the manufacturer whose product is pictured above. First, develop the simplest design that will do the job. And second, use a compound based on CHEMIGUM nitrile rubber.

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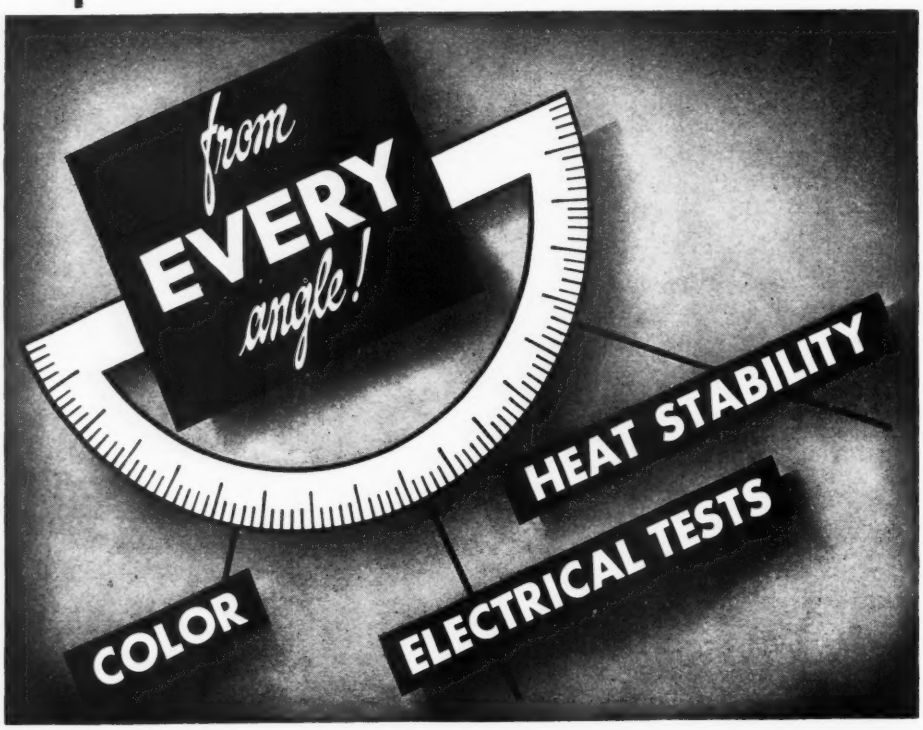
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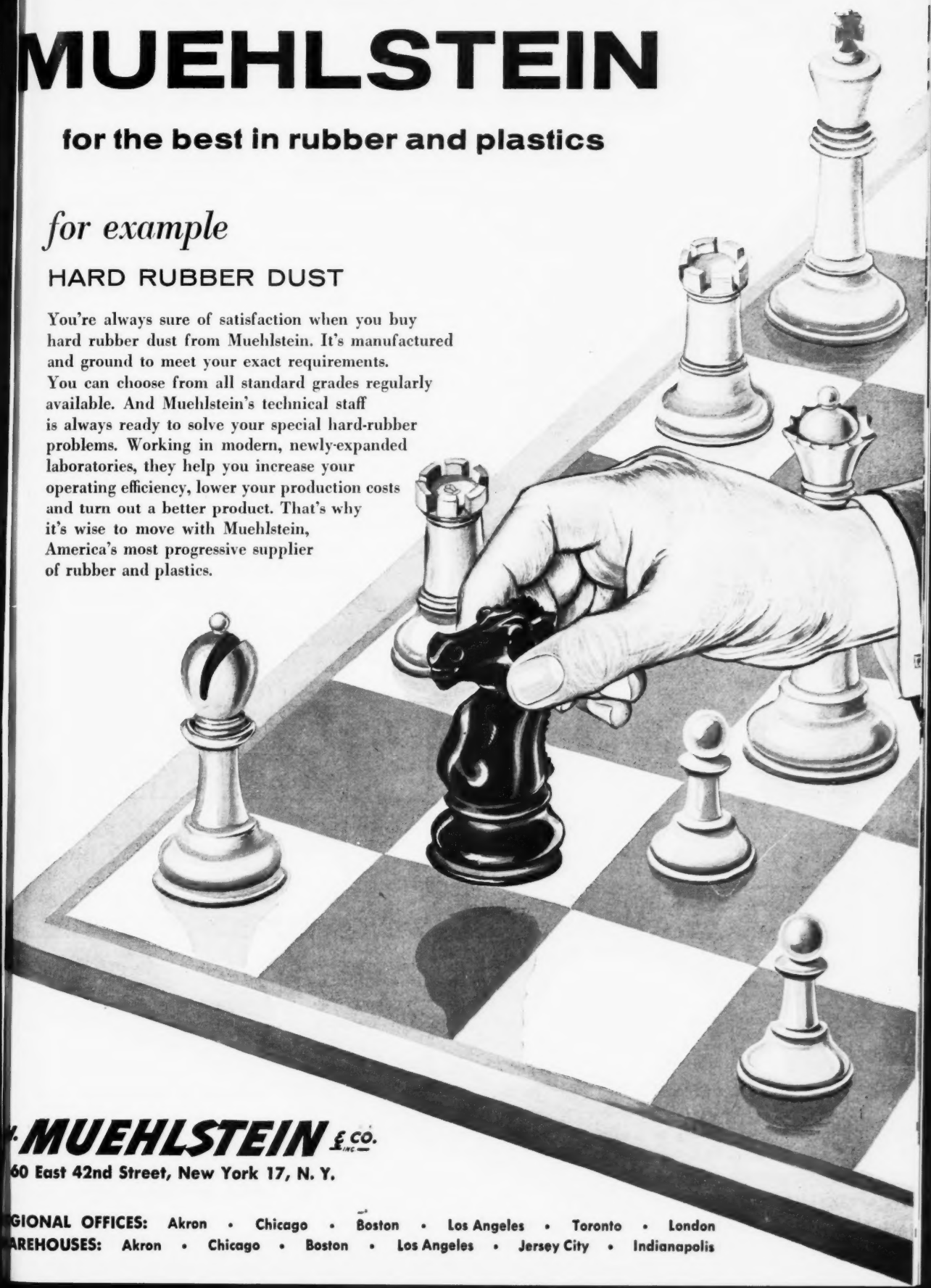
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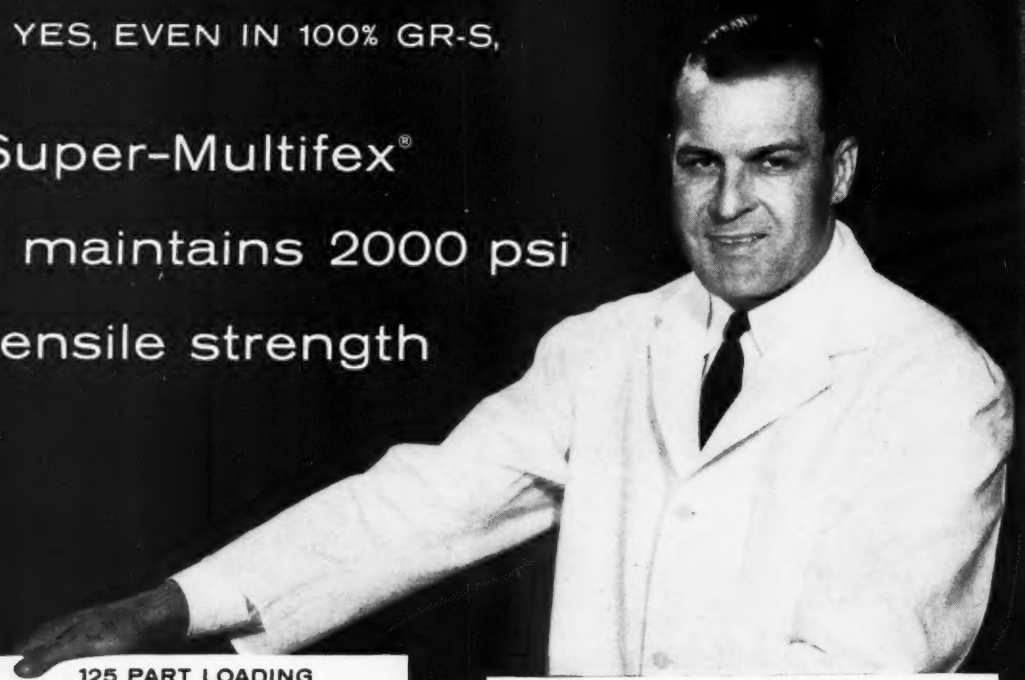
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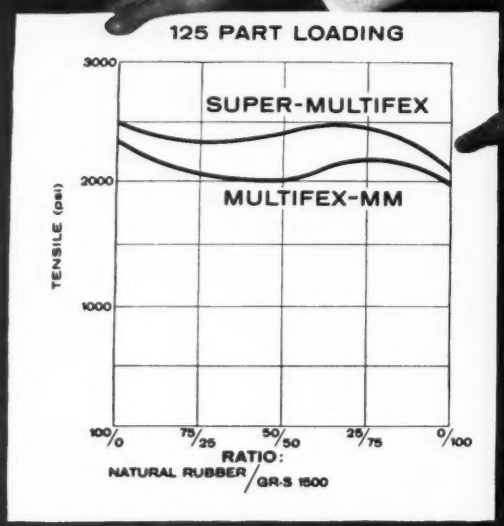
60 East 42nd Street, New York 17, N. Y.

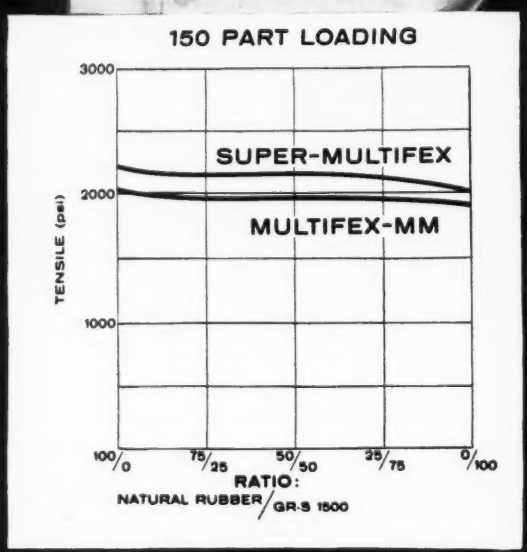
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YES, EVEN IN 100% GR-S,

Super-Multifex® maintains 2000 psi tensile strength







Now you can use DIAMOND Super-Multifex in your GR-S compounds—even in those with *no* natural rubber—and be sure you're getting at least 2000 psi tensile strength.

Contrast the performance of Super-Multifex and Multifex-MM® with the much lower tensiles normally obtained in compounds containing ground limestone.

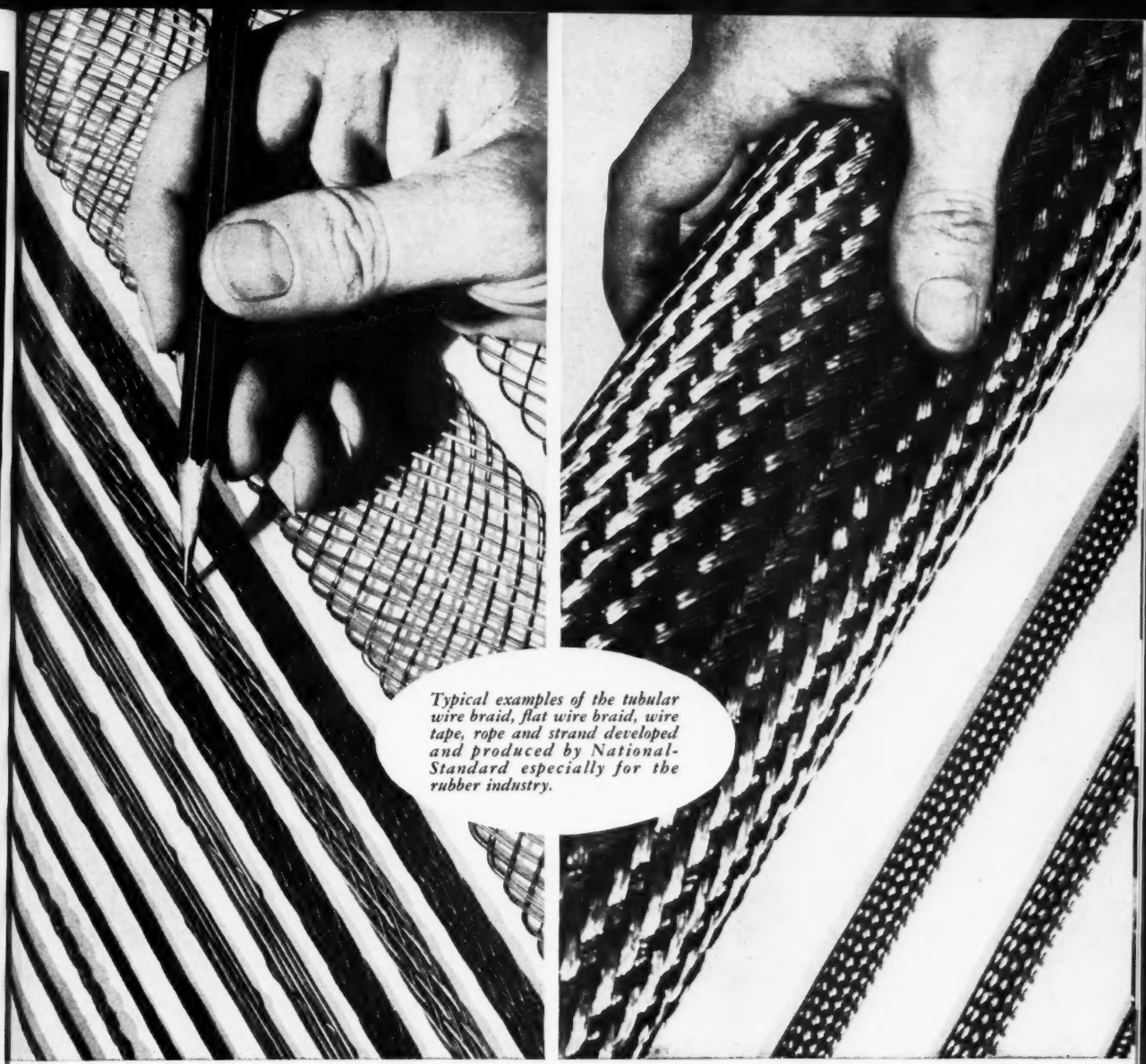
DIAMOND's ultra-fine Super-Multifex (.03 micron) precipitated calcium carbonate has extremely uniform particles, coated to aid dispersion, mixing and processing.

Multifex-MM, also shown on the graphs, is an uncoated, ultra-fine (.04-.06 micron) precipitated calcium carbonate. You can see how it consistently reinforces GR-S, too.

Try either Super-Multifex or Multifex-MM in your next batch to improve physical properties. Call your DIAMOND Representative today. He can supply information and technical help on these and other high-grade calcium carbonates. Or write DIAMOND ALKALI COMPANY, 300 Union Commerce Bldg., Cleveland 14, Ohio.

DIAMOND CHEMICALS®

Diamond Chemicals



Typical examples of the tubular wire braid, flat wire braid, wire tape, rope and strand developed and produced by National-Standard especially for the rubber industry.

Wherever wire and rubber work together...

• For half a century, National-Standard has dedicated large scale research and engineering to improving the teamwork of wire and rubber. It is still going on . . . extensive work on wire fabrication, finish, corrosion, strength, elongation, adhesion and other factors that can affect the behavior and cost of your wire-in-rubber products.

So, wherever wire and rubber must work together, it is more than likely that National-Standard can contribute—particularly where new production or new service requirements are involved. We want to be of help . . . and are geared to do it well, without obligation. Check with us now . . . or anytime!

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DIVISIONS: NATIONAL-STANDARD, Niles, Mich.; *tire wire, stainless, music spring and plated wires* • **WORCESTER WIRE WORKS, Worcester, Mass.;** *high and low carbon specialty wires*
WAGNER LITHO MACHINERY, Secaucus, N. J.; *metal decorating equipment* • **ATHENIA STEEL, Clifton, N. J.;** *flat, high carbon spring steels* • **REYNOLDS WIRE, Dixon, Ill.;** *industrial wire cloth*

Goodrich-Gulf Chemicals, Inc.

Ameripol Code	REMARKS	APPLICATIONS
HOT POLYMERS		
1000	General purpose hot rubber adaptable to most black products or products where color is unimportant.	Tires, molded and extruded mechanical goods, and many general purpose applications.
1001	More resistant to staining and discoloring than 1002.	Tires, molded and extruded mechanical goods, shoe soles and heels.
1002	Higher tensile and lower modulus in cured compounds than 1000 or 1001. Tends to slower curing, thus some adjustment might be necessary.	Tires, molded and extruded mechanical goods.
1006	Improved non-discoloring and non-staining polymer.	Light colored and white products such as white side-wall tires, shoe soles, floor tile, toys, etc.
1007	A glue-acid coagulated staining polymer with relatively low water absorption, low ash, and improved electrical properties.	Wire and cable insulation, electrical matting, gaskets, hard rubber products, etc.
1009	Non-staining cross-linked polymer. Use of small quantities with other type polymers effectively reduces shrinkage and die-swell in calender and extrusion operations.	Wherever control of shrinkage is important—footwear, wire and cable insulation, calendered sheet goods, camelback, soles and heels.
COLD NON-OIL POLYMERS		
1500	General purpose cold rubber where color and staining is unimportant.	Tires, camelback, molded and extruded mechanical goods.
1501	Same as 1500 except slightly staining stabilizer which permits use in some darker colored products.	Tires, molded mechanical goods.
1502	Relatively non-discoloring and non-staining cold rubber.	Light colored and white products such as white sidewall tires, white and light colored mechanical goods, floor tile, hospital sheeting, toys, shoe soles and heels.
COLD OIL-EXTENDED POLYMERS		
1703	General purpose relatively non-discoloring, non-staining polymer containing 25 parts oil. Presence of naphthenic oil may affect stain characteristics.	Light colored and white products—tires, mechanical goods, floor tile, hospital sheeting, toys, shoe soles and heels.
1705	General purpose polymer containing 25 parts aromatic oil for use where staining, discoloring is unimportant.	Tires, camelback, molded and extruded mechanical goods.
1707	Similar to 1703 but for 37.5 parts naphthenic oil, and emulsified with rosin soap rather than mixed soaps.	Tires, camelback, shoe soles and heels, molded and extruded mechanical goods.
1708	Relatively non-discoloring, non-staining polymer containing 37.5 parts naphthenic oil. Glue acid coagulation provides lower water absorption and improved electrical properties.	Wire and cable insulation, athletic goods, coated fabrics, molded and extruded mechanical goods.
1710	Similar to 1705 except for 37.5 parts of an aromatic oil.	Tires, camelback, molded and extruded goods.
1712	General purpose oil extended for use where color is unimportant. 37.5 parts high aromatic oil.	Tires, camelback, molded and extruded mechanical goods, wire and cable insulation.

selection guide to *Ameripol* man-made rubber

Ameripol man-made rubber is a preferred material for conveyor and drive belts, rolls, extrusions, molded goods, and many other industrial products. Ameripol is superior to natural rubber in resistance to wear, water, and chemicals. Superior aging properties can be provided by compounding techniques.



A 24-page booklet "Ameripol—the preferred rubber" lists technical data, specifications, and physical properties. To get the facts on this preferred material write for your free copy today.

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THESE HAF MASTERBATCHES are widely used in tread stocks and other tire applications. They find particularly effective use in the manufacture of camelback, and also have proved their excellence in the production of high quality mechanical goods and other molded products.

THEY ARE AVAILABLE in the following formulations:

Cold, Black Pigmented

BAYTOWN	% BOUND STYRENE	COMPOUNDED MOONEY	EMULSIFIER	BLACK Type	BLACK PHR
1600	23.5	65 - 80	Rosin Acid	HAF	50
1601	23.5	62 - 74	Mixed Acid	HAF	50
1602	23.5	77 - 92	Mixed Acid	HAF	50

Cold, Oil Extended and Black Pigmented

BAYTOWN	% BOUND STYRENE	MEAN COMPOUNDED MOONEY	EMULSIFIER	OIL Type	OIL PHR	BLACK Type	BLACK PHR
1801	23.5	65	Mixed Acid	Naphthenic	25	HAF	50

UNITED CARBON COMPANY, INC.

A subsidiary of United Carbon Company

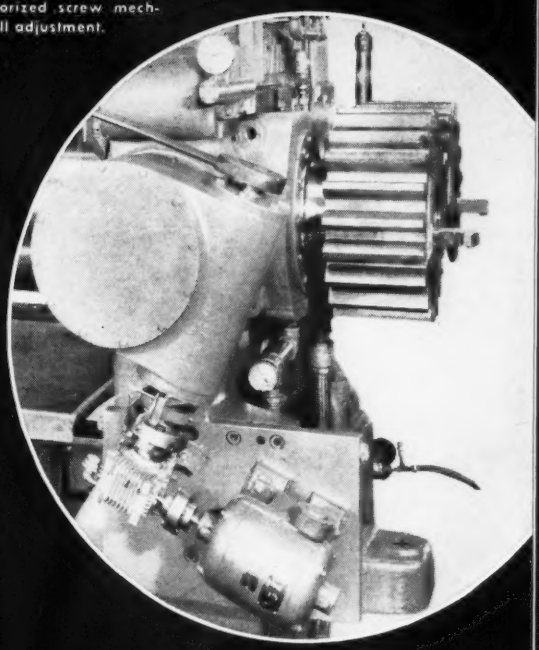
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24" x 60" Phenolic Mill with individual bull gear drive for each roll, using one constant speed motor and one variable speed motor for main drive.



Special motorized screw mechanism for roll adjustment.

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ADAMSON UNITED MILLS

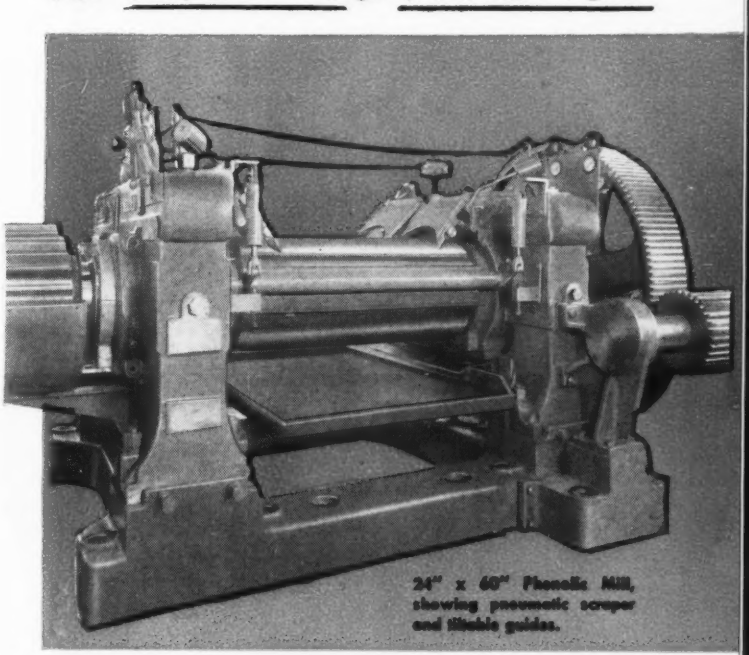
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we can design . . .
build and install
the right mill
for your requirements

A STANDARD MILL may be all you need. But often the kind of stock to be processed, temperature, gage and production rate, may require an entirely new type of specially designed mill.

Given the necessary data, our engineers, who are thoroughly familiar with today's rubber and plastics processing problems, will modify an existing type of mill or create a new design to exactly meet your requirements. Because the unusual is *usual* at ADAMSON, numerous concerns, for many years, have been turning over their process problems to us to carry through from blueprint to point of production. Our business has been built on that kind of service.

Why not call us in on your next mill installation? There'll be no obligation on your part.



24" x 60" Phenolic Mill, showing pneumatic scraper and tilttable guides.

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Plants in PITTSBURGH — HENDERSON — YOUNGSTOWN — CANTON — WILMINGTON

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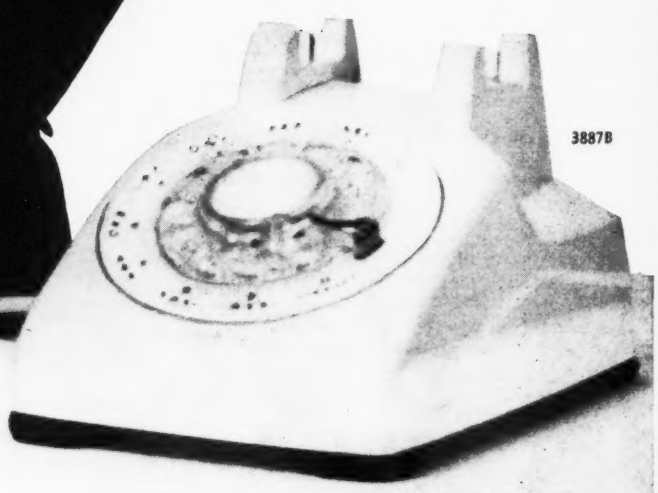
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As whitening, brightening and opacifying agents, nothing can surpass TITANOX titanium pigments for adding eye-appeal to plastics. Titanium Pigment Corporation (subsidiary of National Lead Company), 111 Broadway, New York 6, N. Y.; Atlanta 5; Boston 6; Chicago 3; Cleveland 15; Houston 2; Los Angeles 22; Philadelphia 3; Pittsburgh 12; Portland 14, Ore.; San Francisco 7. In Canada: Canadian Titanium Pigments Limited, Montreal 2; Toronto 1.

*TITANOX is a registered trademark for titanium pigments sold by Titanium Pigment Corporation.



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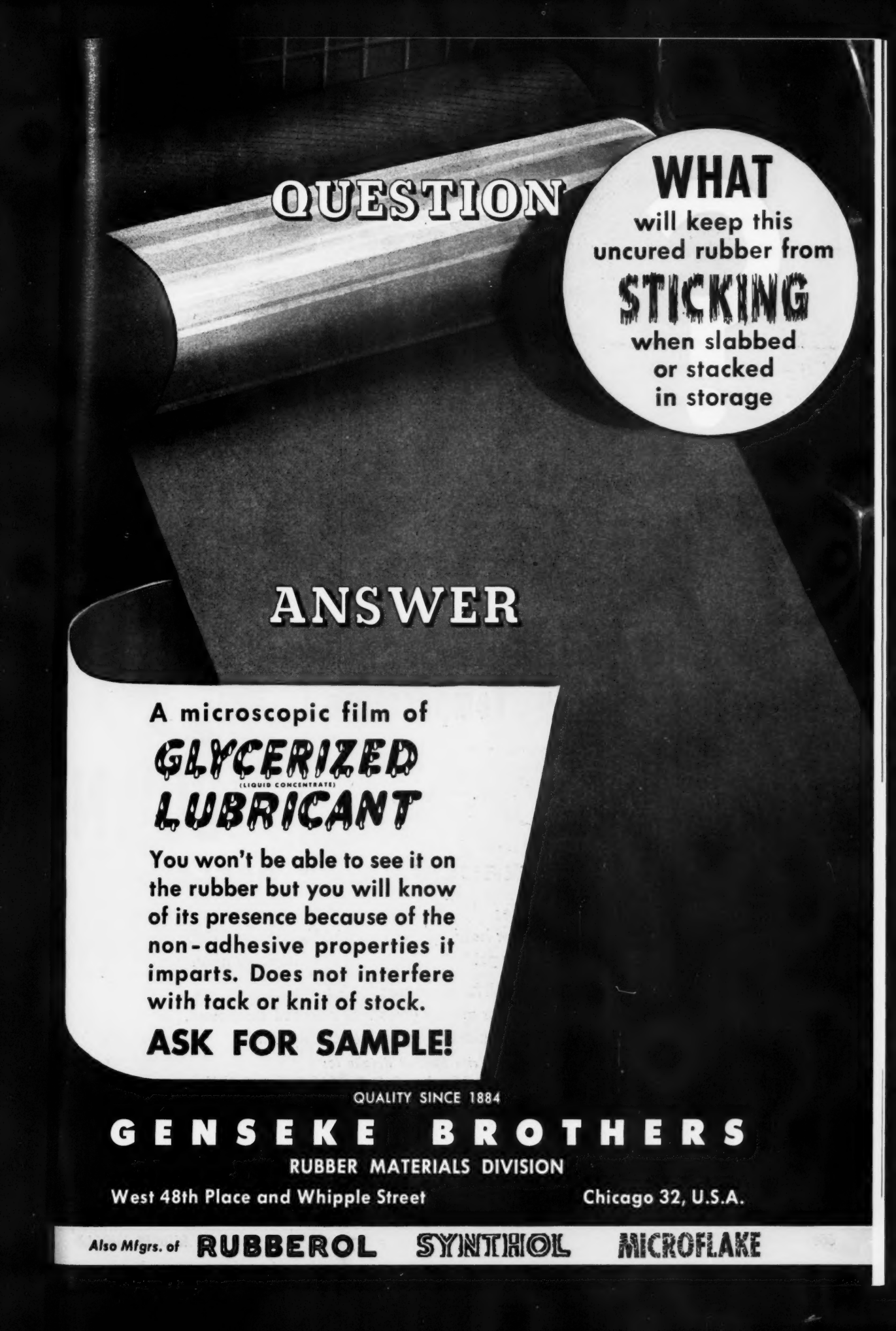
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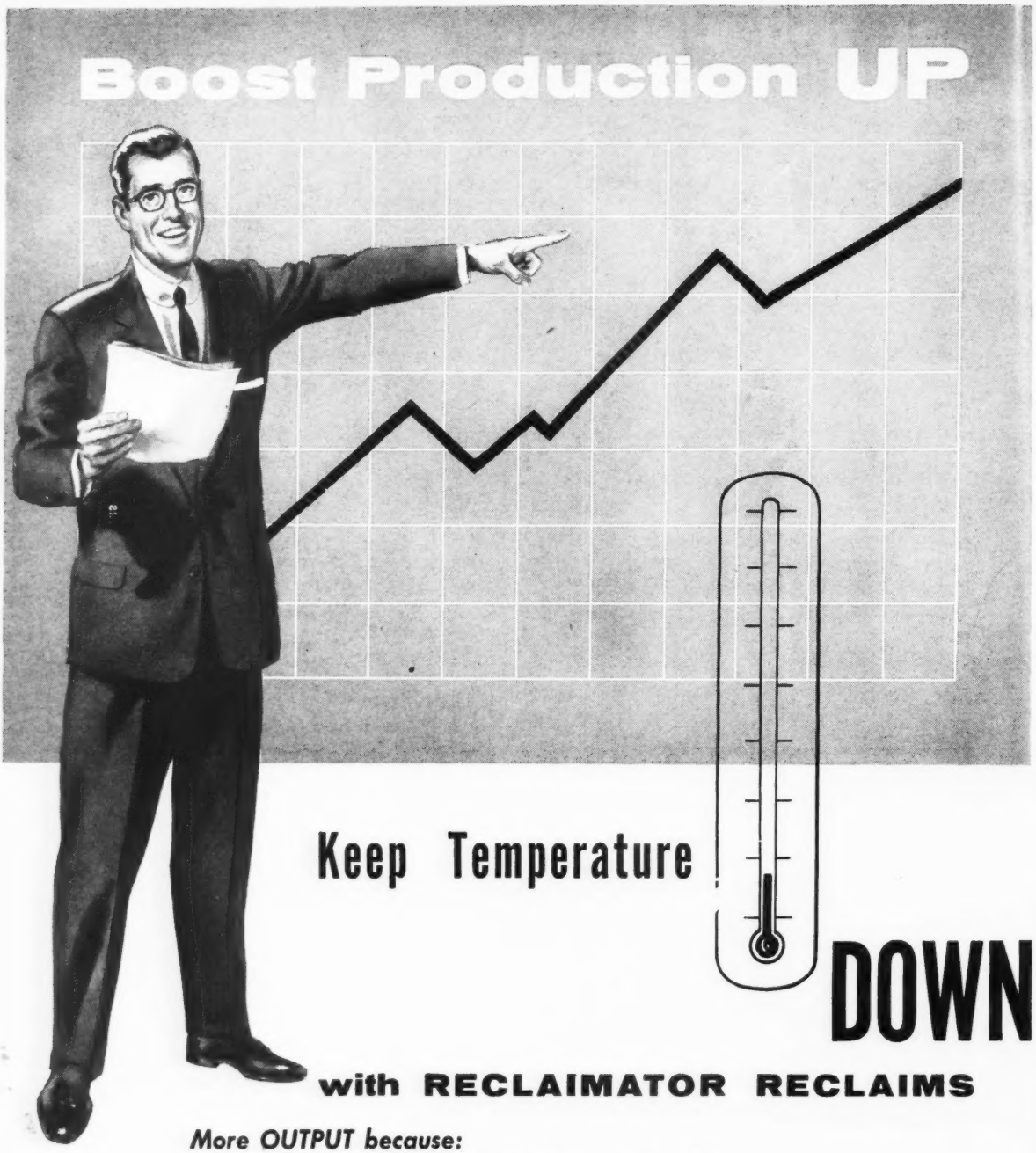
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will keep this
uncured rubber from
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when slabbed
or stacked
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A microscopic film of
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You won't be able to see it on the rubber but you will know of its presence because of the non-adhesive properties it imparts. Does not interfere with tack or knit of stock.
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More USABLE COMPOUND because:

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Trenton Agent: H. M. Royal, Inc., 689 Pennington Ave., Trenton, N. J.

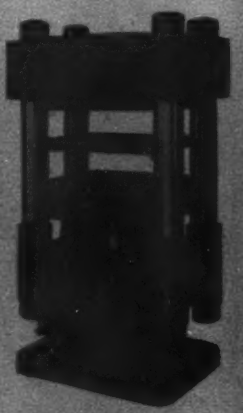
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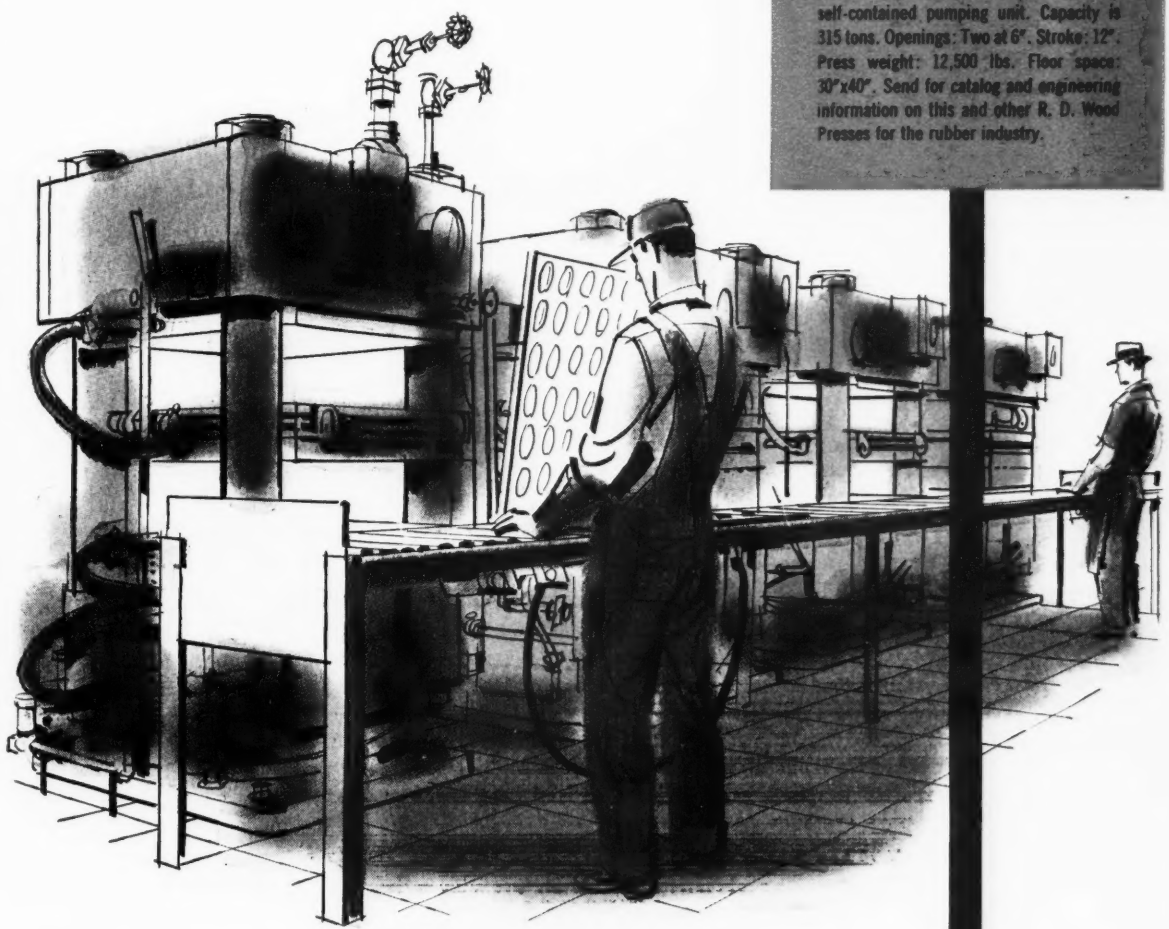
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Put a Wood Press to work and get the money-saving advantages of smooth, dependable performance . . . long operation with low maintenance.

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RUGGED TRAFFIC CONDITIONS—Almost 1600 tons of coarse, heavy slate are transported daily by means of this sturdy 30″ conveyor belt at The Southern Lightweight Aggregate Corporation's plant in Bremo Bluff, Virginia. This slate is first carried to huge crushers and then to kilns where it is transformed into SOLITE, a unique new aggregate used in the manufacture of structural concrete and lightweight masonry units that are just as strong as ordinary concrete units, but one-half lighter. Because of the continuous barrage of sharp, angular slate to which this particular belt is subjected, it required special engineering. It was manufactured by Boston Woven Hose and Rubber Company from fabrics especially developed for extremely rough usage by Mount Vernon Mills. Already, the belt has been in continuous use for over two years and is expected to remain serviceable for at least another—twice as long as any other belt ever before utilized for this brutal carrying operation.

This is another example of how fabrics made by Mount Vernon Mills, Inc. and the industries they serve, are serving America. Mount Vernon engineers and its laboratory facilities are available to help you in the development of any new fabric or in the application of those already available.

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large-scale output assures ample raw materials for mass-produced urethanes

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They can be used either as coatings or as adhesives. Coating textiles with Vulcanols provides dimensional stability, pile anchorage, slippage resistance, non-skid and non-fray properties and desired hand.

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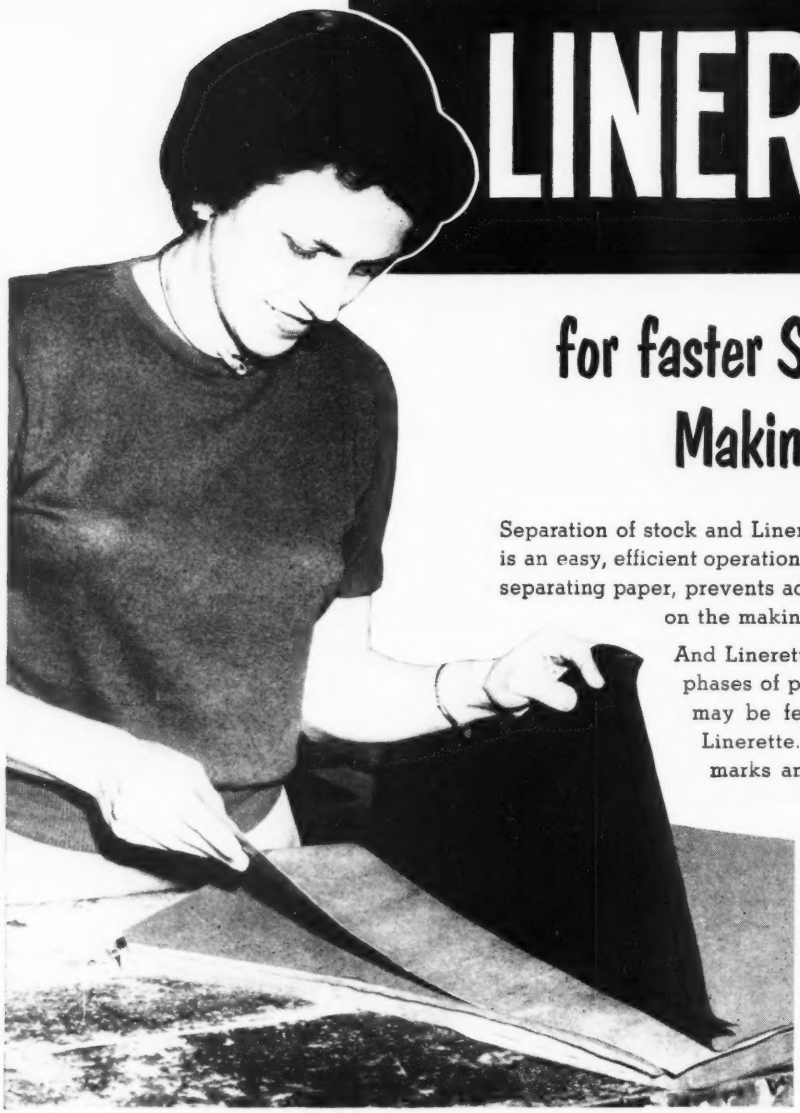
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and this uniform COPO cold rubber protects against variations in products produced from less uniform raw materials.

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Linerette supplies additional savings when used in shipping lightweight stocks—there is no need to return a fabric liner. Where cleanliness is a vital factor, Linerette serves as a low cost lining for trays and containers.

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for new equipment, spares or replacements . . .



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FOR EVERY

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When you specify UNITED ROLLS, your complete satisfaction is guaranteed by over 50 years' experience in the design and manufacture of rolls for practically every type of rolling application. Precision engineered to the specific requirement of the individual machine or equipment in which they are to be used, UNITED *Service-Proved* ROLLS are in use the world over by processors of rubber, plastics, linoleum, paper, paint and scores of other metallic and non-metallic substances.

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It only existed in specifications.

The U. S. Army wanted a fuel hose with 4″ inside diameter and burst pressure of 500 PSI; so flexible and light it could be payed out of a truck or helicopter at 50 miles an hour.

It only existed on paper. Now it is fact—with Fortisan-36. Using this new Celanese fiber as reinforcing yarn, U. S. Rubber—and the U. S. Army—solved a seemingly impossible problem at low cost. Fortisan-36 has tremendous tensile strength (twice that of viscose rayon, for example) at light weight. Practically speaking, it doesn't stretch under pressure. Nor do temperature and moisture changes affect its dimensions. It is a remarkable fiber and it makes remarkable hoses. V-belts, conveyer belts, tarpaulins, too.

Remember—Celanese not only delivers its fibers, but its technical skills as well. Let us put Fortisan-36 on the job—together. Celanese Corporation of America, Industrial Sales Department, Textile Division, Charlotte, North Carolina. Celanese®

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233

BEST IN TRANSPARENT RUBBER, TOO

HI-SIL®



Interest has increased greatly during recent months in transparent rubber stocks for "crepe" soling and other specialty molded goods.

Columbia-Southern anticipated this interest years ago and set up an extensive research project in the transparent rubber field. The results are now published (*Rubber Age,* January 1957) and will soon be reprinted in our technical bulletin series. If you are not on our regular mailing list, you may reserve a copy by addressing Room 1929W at Pittsburgh or any of our district sales offices.

Tests indicate Hi-Sil 233 to be the best available reinforcing pigment for transparent applications. Commercial stocks with an excellent level of physicals can be produced as transparent compounds with this specific reinforcing silica.

Loadings as high as 97.5 parts (50 volumes) still give excellent transparency in PLIOFLEX* 1778, a new oil-extended polymer. This stock will whiten when flexed, but aptly demonstrates the limits that can be reached. Reducing the pigment loading in PLIOFLEX 1778 to 40 volumes (78 parts) results in a useful compound of middle 80 Durometer hardness. At lower loading levels, other GR-S types are suitable.

A serious investigation of color in transparent compounds was beyond the scope of this work. However, preliminary efforts showed that production of colored stocks is completely practical.

Technologists and others who may be intrigued by transparent rubber possibilities are invited to contact us today for more information.

*PLIOFLEX—TM, The Goodyear Tire & Rubber Co.



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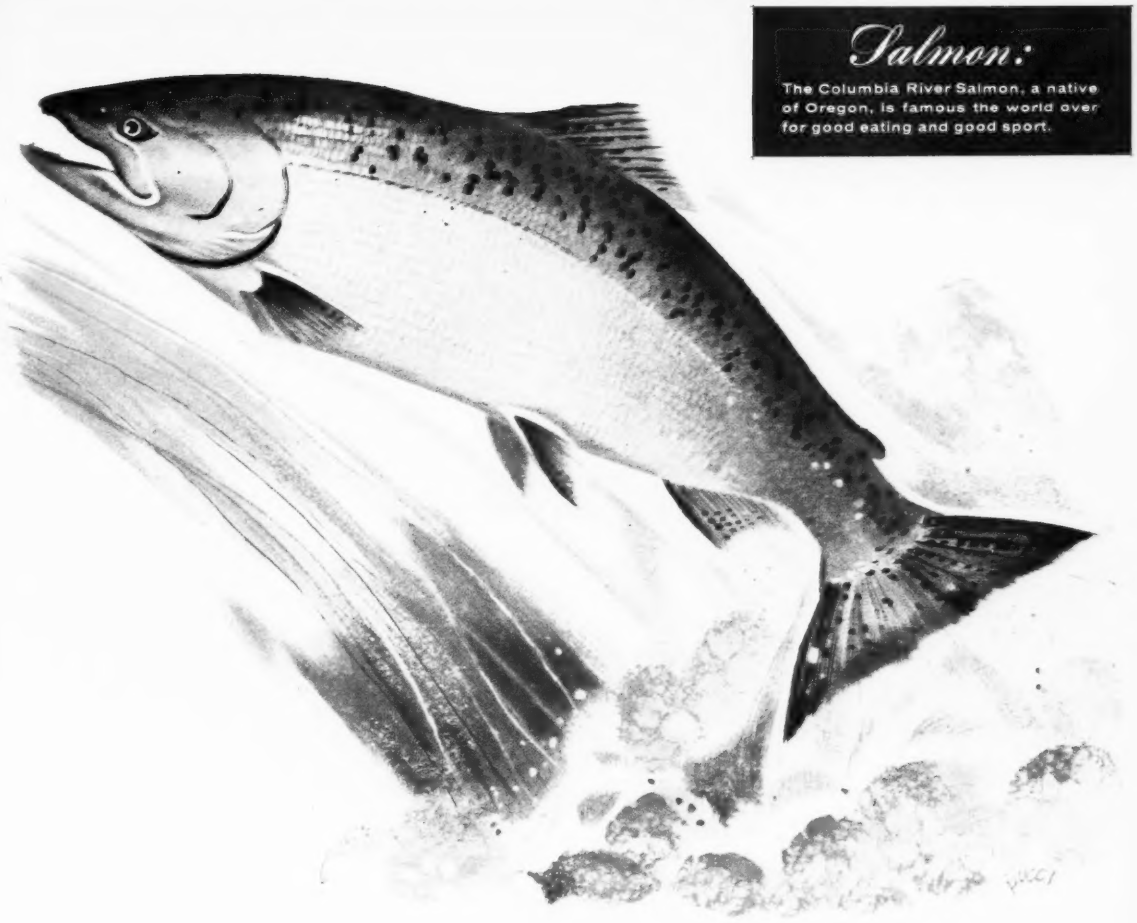
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For service on regular orders . . . for emergency service any time . . . call The C. P. Hall Company's nearest office.



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Salmon:
The Columbia River Salmon, a native of Oregon, is famous the world over for good eating and good sport.

SYNTHETIC RUBBER

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ADD SYNTHETIC RUBBER to the many bounties of the West! Shell Chemical's plant at Torrance, California, produces a full line of butadiene-styrene type synthetic rubber to fill the needs of large and small Western manufacturers.

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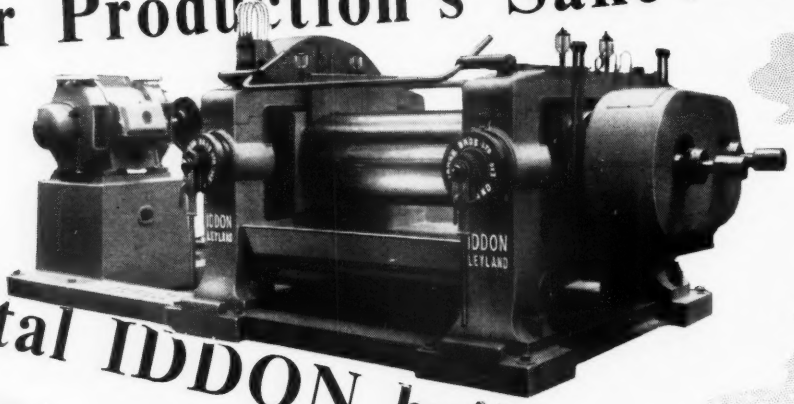
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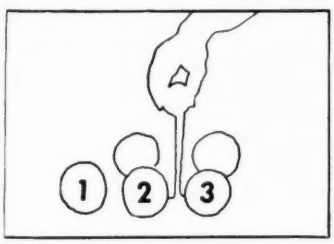
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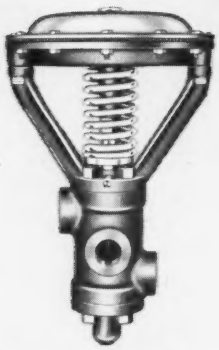
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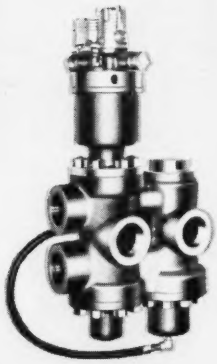
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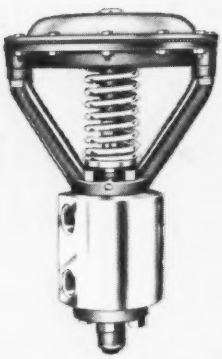
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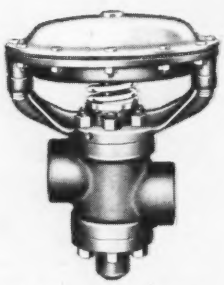
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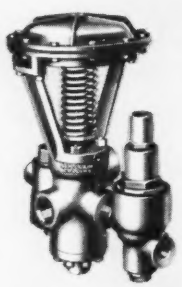
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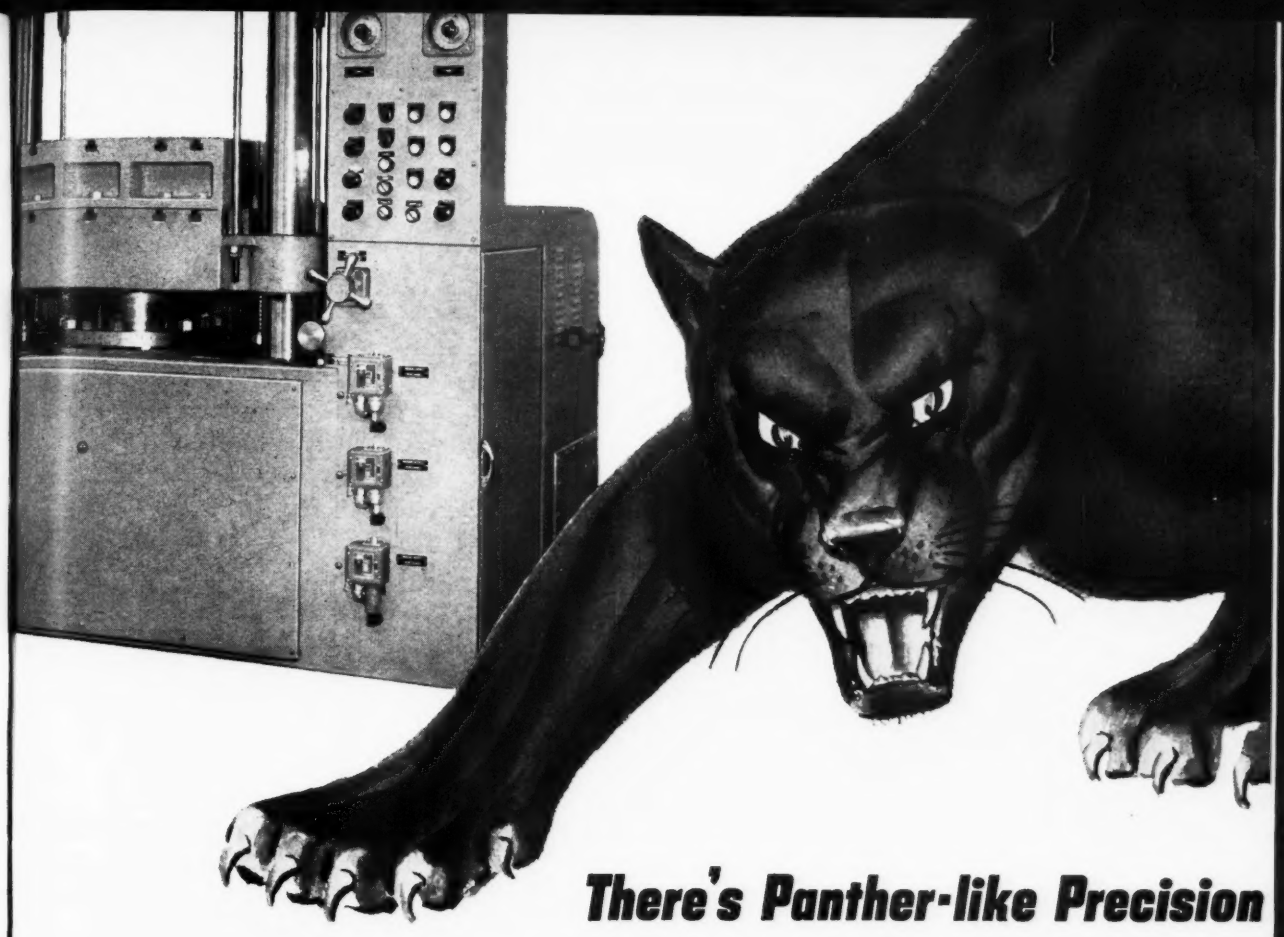
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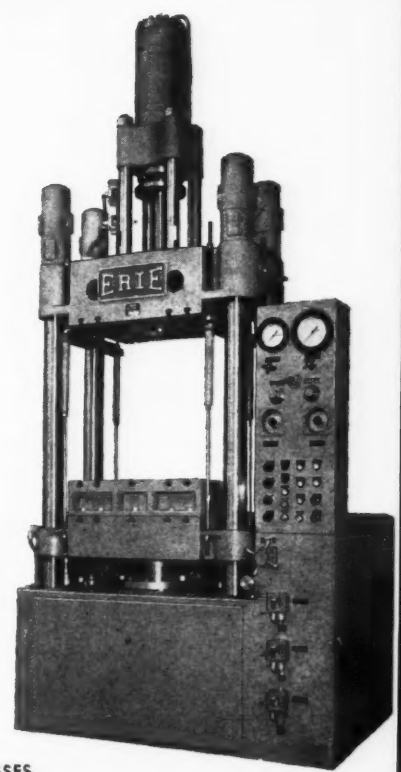


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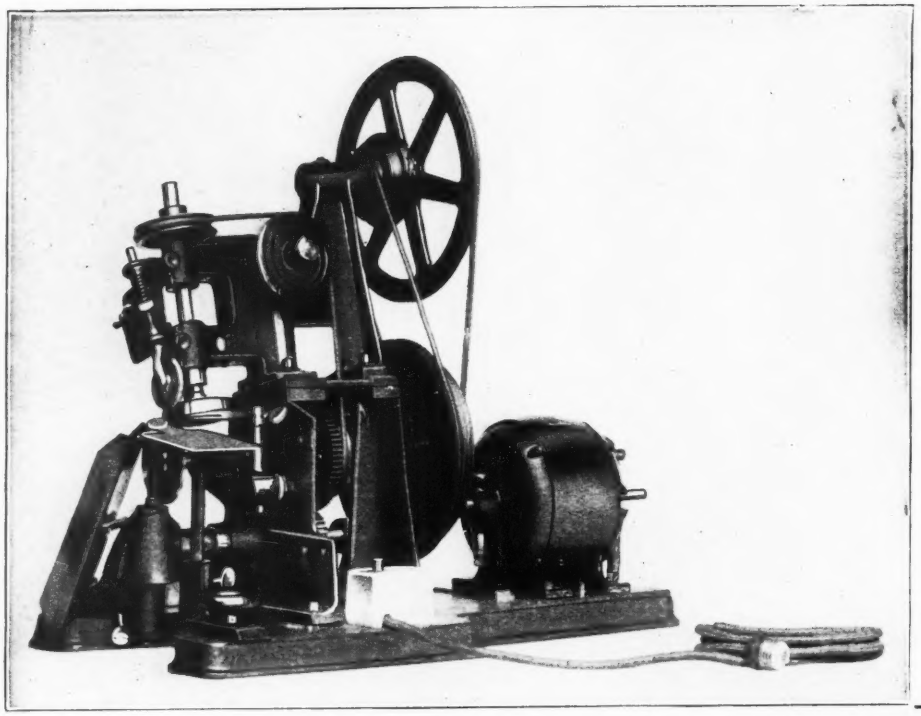
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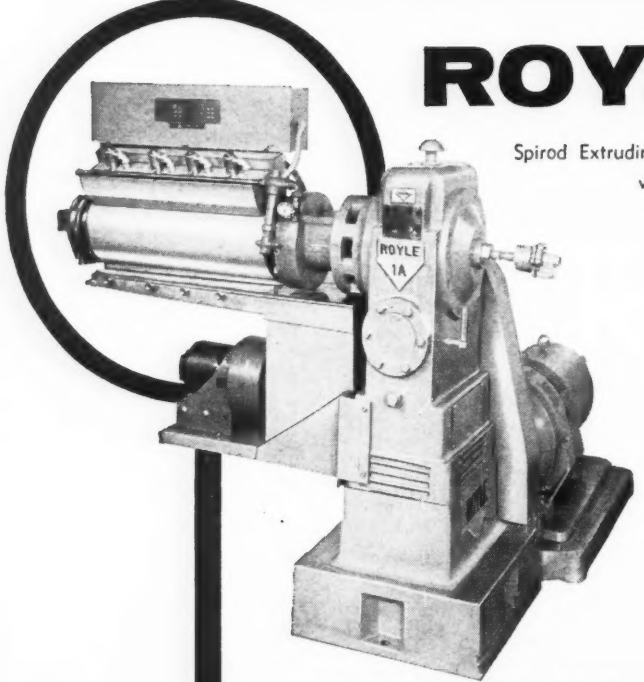


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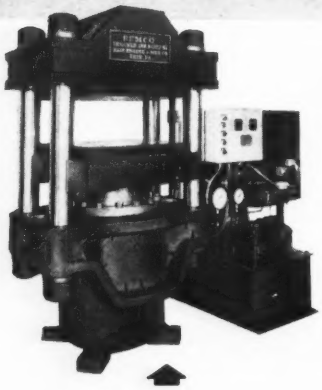
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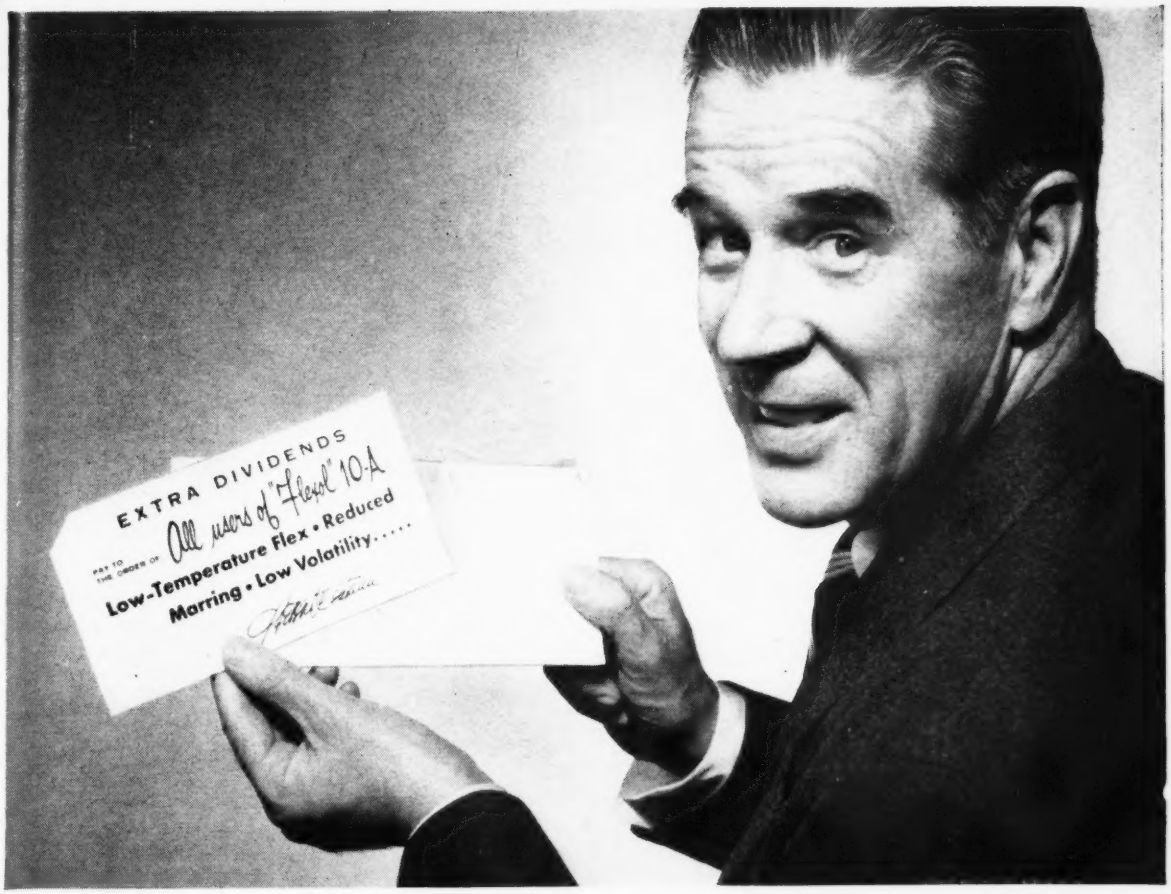
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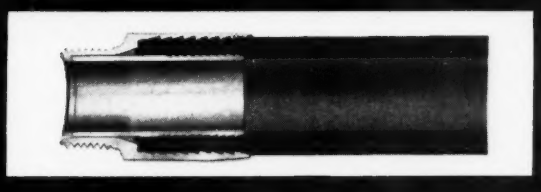
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DOW

In their brief but exciting history, chelating agents have encountered reactions ranging from scoffs and disbelief to overzealous exaggeration about their application. But the air is clearing. Already they are serving as important tools in many industrial processes. This is the beginning of a series on chelating agents designed to further clarify what they are, what they will do—and won't do.

The Chemistry of Chelation: Part I

Chelation defined · Example of the reaction · Variety of applications · Future of chelating agents

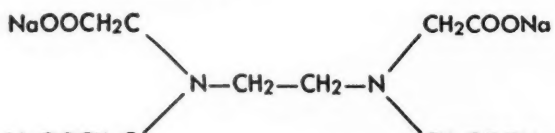
Polymerization of synthetic rubber controlled . . . soap kept white and sparkling on the dealer's shelf . . . textiles bleached and dyed with permanent uniform colors . . . pharmaceuticals stabilized. Unrelated reactions? Certainly. However, all are accomplished by a group of closely related chemicals called chelating agents. How do they work? Well, it's not magic, but chemistry—in a way, fairly basic chemistry. But let's begin at the beginning.

What Is Chelation?

Let's look at the word chelation. It is derived from the Greek word *Kelos* which means "claw." Simply stated, a chelate is a claw which holds a metallic ion inactive in solution. Chemically stated, chelation is a chemical reaction in which polyvalent metallic ions are reacted with organic reagents (chelating agents) to chemically inactivate these polyvalent metallic ions in the form of an extremely stable, water-soluble chelate.

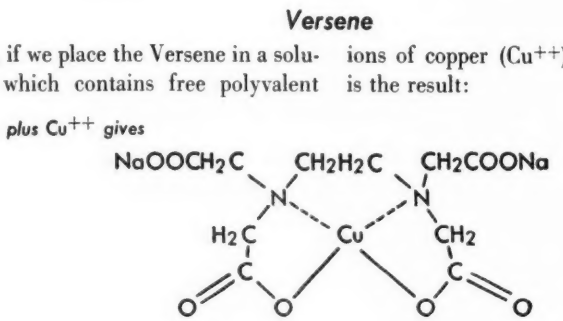
Typical Reaction

If we examine a typical reaction, the process of chelation becomes quite clear. Let us take, for example, the chemical structure of Versene®, one of the Dow chelating agents.



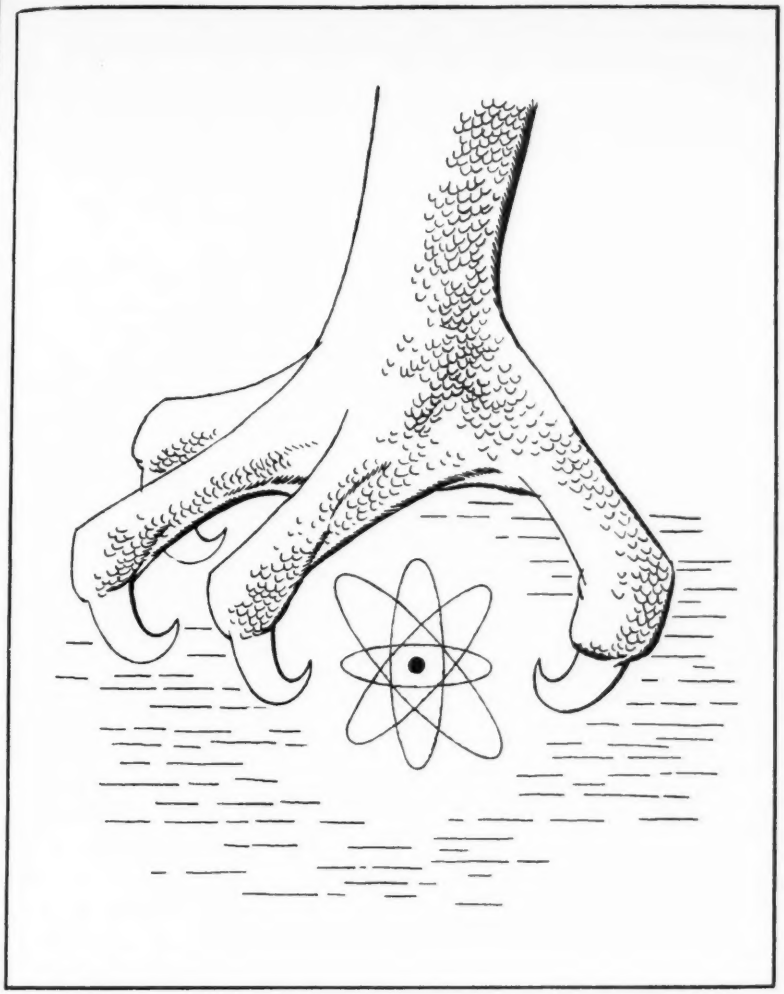
Versene

Now, if we place the Versene in a solution which contains free polyvalent ions of copper (Cu^{++}), the following is the result:



Versene Copper Chelate

The resultant compound is Versene copper chelate. The copper ion has become a member of an inner ring structure in the molecule. The result?



It is inactivated. It cannot react with soap to cause darkening and stain during storage.

It can't cause breakdown of pharmaceuticals. It can't cause any trouble anywhere because it is locked in the Versene claw. It will stay locked in unless it is desired to reverse the process. This reverse action is used in polymerization of synthetic rubber—ions of iron being released at a predetermined rate by the chelate.

Variety of Applications

The most important thing, however, is that this "claw" property of chelating agents such as Versene makes it possible to solve a multitude of processing problems in industry. They've been used in tanning leather and tenderizing peas.

They can descale boilers, soften water and cure acute lead poisoning. The number of current industrial and medical applications is large, but the potential in unexplored areas is enormous.

And the Future?

The future of these products will hinge on the imagination and insight of chemists and engineers, of production men and purchasing agents, in nearly every industry. Wherever metal contamination poses a problem or wherever controlled introduction of metal ions is desirable, these chemicals warrant investigation.

Versene and other Dow chelating agents won't solve them all. Chelation is not a panacea. It will work chemically in some areas—it will fail in others. However, it is Dow's intention to assist in every way in the uncovering of processes in which chelating agents can be profitably used. Inquiries on your company letterhead will be handled with dispatch. We will be pleased to provide information and technical assistance. Write to Technical Service and Development, Dept. CA 900D, THE DOW CHEMICAL COMPANY, Midland, Michigan.

The next two topics in this series

PART II The Versene and Versenol® series of Dow chelating agents (what they are, strength and stability features—Versenol lower cost, less strength). Also—how chelating agents are specified (product performance versus chemical composition).

PART III Specific chelating agents for specific applications. Polymerization of synthetic rubber (development of Versene Fe-3 for controlled release of traces of metal used as catalyst—improvement in process that results).

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RUBBER WORLD

EDITORIAL

FEBRUARY, 1957

Industry Help Needed with Government S.I.C.'s

WE TRIED to point out the need of modernization of the Commerce Department's Bureau of Census "Standard Industrial Classifications," as applied to the rubber and rubber products industry, in this column in December, 1956. Specifically we objected to the four major product classifications in "S.I.C. 30—Rubber Products," of (1) tires and inner tubes; (2) rubber footwear; (3) reclaimed rubber; and (4) rubber products, not elsewhere classified, *as not being major product classifications as far as rubber footwear and reclaimed rubber were concerned, and as being more than one major product classification as far as rubber products, n.e.c., was concerned.*

We have learned just recently that the Federal Government's Bureau of Budget in its proposed new "S.I.C. 30—Rubber and Miscellaneous Plastics Products" is apparently trying to handle the rubber products industry and the plastics products industry as *one single group.* Also, in its proposed new "S.I.C. 28—Basic Chemicals and Petroleum Refining" is included a section on synthetic rubber that is both incomplete and confusing.

The proposed new "S.I.C. 30—Rubber and Miscellaneous Plastics Products" presents several problems. Among these is the fact that although the rubber products industry has been manufacturing an increasing number of products from plastics materials, the industry will need to decide promptly whether or not it wishes its industry statistics lumped together with those of the plastics products industry in the future. For that matter, the plastics products industry, as such, might want to consider the advisability of having its statistics grouped with those for rubber products.

The section on synthetic rubbers in "S.I.C. 28—Basic Chemicals and Petroleum Refining" will have to be brought up to date, made complete, and a more generally accepted terminology used. In this connection the American Society for Testing Materials has just published in its "1956 Supplement to Book of ASTM Standards—Part 6" its Tentative Recommended Practice for Nomenclature for Synthetic Elastomers and Latices — ASTM Designation: D1418-56T, which provides a much better classification than that of the Budget Bureau.

Returning again to "S.I.C. 30—Rubber and Miscellaneous Plastics Products," it is our opinion that the major product classification, "fabricated rubber and plastics products, not elsewhere classified," should be divided into two or more major product classifications. We suggest a major product classification for "mechanical rubber goods," for "heels and soles," and then "fabricated rubber and plastics products, n.e.c." In the 1954 Census of Manufactures, shipments of "mechanical rubber goods" amounted to $1.1 billion of the $1.7 billion total "n.e.c." classification, and "heels and soles," to $113 million.

In addition, why should "camelback and tire repair materials," with 1954 shipments valued at about $108 million, and "factory rebuilt or retreaded tires," with 1954 shipments valued at more than $30 million, be in the n.e.c. classification instead of a part of the tire and inner tube branch of the industry?

Rubber industry groups act in an advisory capacity to the government in connection with these Standard Industrial Classifications, as well as in other matters. These advisory groups should not miss this opportunity to make this government service of real value to the industry.

R. G. Seaman

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Resistance of Rubber Compounds to Outdoor and Accelerated Ozone Attack[1]

By C. V. LUNDBERG, G. N. VACCA, and B. S. BIGGS

Bell Telephone Laboratories, Inc., Murray Hill, N. J.

Styrene-butadiene and neoprene rubber compounds were exposed statically outdoors in Los Angeles, Calif., and Murray Hill, N. J., for 18 months and in Yuma, Ariz., for 15 months, and in ozone chambers at three different temperatures as well as two different ozone concentrations.

Observations of ozone cracking have been correlated to show the relative severity of atmospheric ozone cracking at the three outdoor locations, and the data obtained in the chamber exposures have been correlated with the outdoor observations.

Additional compounds of natural, nitrile, SBR, and butyl rubbers have been exposed outdoors at Murray Hill and in the ozone chambers to determine the relative behavior of these materials.

The relative effectiveness of waxes, antiozonants, higher than normal concentrations of antioxidants, and combinations of such protective agents in the four polymers has been determined, and certain recommendations have been made.

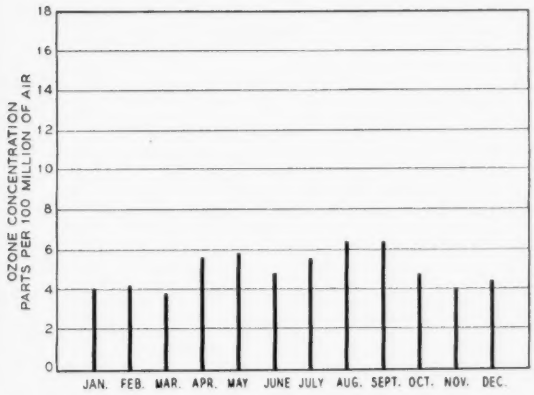


Fig. 1. Maximum monthly outdoor ozone values at Murray Hill, N. J., during 1944

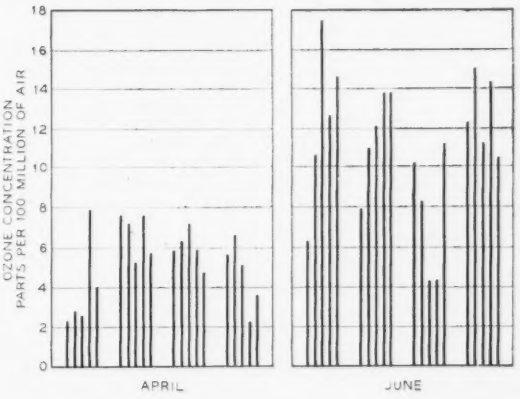


Fig. 2. Daily outdoor ozone values at Murray Hill during April and June, 1956

WEATHERING of rubber compounds can generally be attributed to degradation induced by heat, light, oxygen, and ozone. If only carbon black loaded rubber compounds are considered, light activated oxidation may be eliminated as a serious cause of rubber degradation. For such black compounds protected with ample amounts of effective antioxidants, degradation due to heat and oxygen can be a very slow process, taking many years before serious changes in the physical properties result. The remaining degrading material, ozone, can severely affect strained rubber compounds in a matter of days or weeks, resulting in cracks in the rubber occurring at right angles to the direction of strain.

The mechanism of the ozone cracking of rubber has not been satisfactorily explained as yet, but it is well known that unsaturated rubbers are subject to ozone cracking while saturated rubbers such as silicone and chlorosulfonated polyethylene[2] are not. It is also well known that rubber which is not under an external strain and in which internal strains have been essentially removed during vulcanization does not crack in ozone. One possible exception to this fact is the frosting of rubber, generally attributed to the action of ozone under humid conditions on externally strain-free rubber (1, 2).[3] Even in the case of frosting, the possibility exists for the presence of surface strains even though exterior strains are absent. Frosting affects the appearance, but generally not the utility of a rubber article; while ozone cracking can lead to failure of a rubber part to perform its normal function.

Kohman (3) as well as Newton (4) found that ozone reacts with unstretched rubber. When this ozonized rub-

[1]Presented before the Division of Rubber Chemistry, ACS, Atlantic City, N. J., Sept. 20, 1956.

[2]Hypalon, E. I. du Pont de Nemours & Co., Inc, trade mark.

[3]Numbers in parentheses refer to bibliography references at end of article.

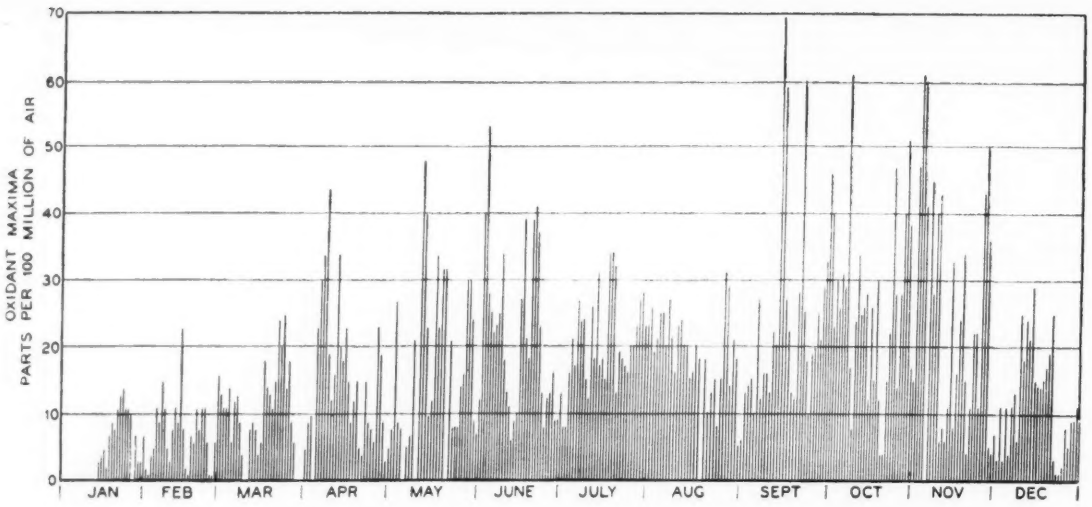


Fig. 3. Maximum daily outdoor oxidant values in downtown Los Angeles during 1955, determined by the Air Pollution Control District, Los Angeles, Calif.

ber is later stretched, it does not crack. Newton, and later Buist (5), have suggested that ozone cracking may be due to scission or a free radical mechanism in which the fragments recombine and produce no observable cracks when the rubber is under no strain. When strain is present, the segments or free radicals are removed sufficiently from one another so that they cannot recombine, and a chain reaction results in visible cracks.

Smith and Gough (6) suggested that visible cracks result when neighboring double bonds in adjacent load carrying molecules react with ozone.

Atmospheric Ozone

Ozone generally occurs in the atmosphere at the earth's surface in concentrations of 10 or less parts per hundred million of air (pphm), and this small concentration is sufficient to crack many strained rubber compounds. Crabtree (7) made measurements of outdoor ozone concentrations at Murray Hill, N. J., in 1944, and the maximum monthly values are reproduced in Figure 1. Daily values ran from almost zero to approximately 6½ pphm. More recently, daily values have been obtained at Murray Hill during the months of April and June, 1956. The April data are in line with the 1944 data, but the June measurements run as high as 17 pphm, with numerous values above 10 pphm. The April and June data are shown in Figure 2.

Measurements (8) have been made in Washington, D. C.; Philadelphia, Pa.; Charleston, W. Va.; Elizabeth, N. J.; St. Louis, Mo.; Akron, O.; Detroit, Mich.; Whiting, Ind.; and Cincinnati, O.; with maximum values of 8, 5, 12, 3, 8, 3, 6, 10, and 8 pph. These values were obtained during the course of one to three days in each city and represent spot checks only. Some of the tests were run in the winter when low ozone values are normally encountered. Gaughan (9) has reported ozone at the Detroit Arsenal to vary up to 12 pphm.

For some time high values of ozone have been associated with a high degree of rubber cracking and with smog in the Los Angeles, Calif., area. Bartel and Temple (10) measured atmospheric ozone in the Los Angeles area in 1949, 1950, and 1951 and obtained a maximum value of 54 pphm, with many maximum daily values in the 25-45 pphm range. Also of interest in their work was the finding of ozone concentrations in the 15-28 pphm range in locations 75 and 110 miles from Los Angeles, in clear, rural, smog-free air.

Since August of 1954 continuous recordings of oxidant level have been made at various locations in Los Angeles County by the Air Pollution Control District. The term "oxidant level" used for the Los Angeles values indicates the same measurement as "ozone concentration," as both are obtained by determining the amount of iodine released by the oxidizing air from neutral buffered potassium iodide solutions (11-13). Daily high values of 30-40 pphm of ozone are encountered during the smog seasons, and highs of 65, 75, and 90 have been reported (13-15). Daily maximum outdoor values of oxidant for 1955 obtained by the Air Pollution Control District at Station 3 located in the Fidelity Building in downtown Los Angeles are plotted in Figure 3.

One would expect such high ozone concentrations to accelerate the cracking of strained rubber and to crack rubbers which normally do not crack at lower ozone concentrations. Nellen, Dunlap, Glaser, and Landes (16) reported that tire test stocks exposed in warehouses in southern California and in Denver, Colo., showed a greater degree of ozone cracking than similar stocks exposed in other sections of the country. Many others have indicated that rubber is more severely attacked by ozone in the Los Angeles area than in the rest of the country.

A survey in Los Angeles showed that rubber coverings on telephone wires were reacting no differently than in other sections of the country. It should be noted, however, that atmospheric ozone has long been considered

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Dr. Biggs was a member of the staff of the coal research laboratory at Carnegie Institute of Technology from 1933 to 1936. He has been at Bell Laboratories since 1936, and his work is primarily concerned with polymer research and development.

He is a member of the ACS and of the Society of the Chemical Industry. He served as chairman of the New Jersey Section, ACS in 1951, and was chairman of the American Association for the Advancement of Science's Gordon Research Conference on Elastomers in 1956.

a serious deteriorating agent by the wire industry, and the wire insulations and jackets in the telephone plant have been engineered to have a high degree of ozone resistance. It was decided, nevertheless, to make a long-term comparison of the crack resistance of a series of rubber compounds when statically exposed in Los Angeles, in Murray Hill, and in Yuma, Ariz. Los Angeles was selected as representing a high ozone area, Murray Hill as a normal ozone area, and Yuma as an area where the prevailing temperature is rather high and where, because of the high percentage of clear days, the ultraviolet incidence is also relatively high.

It was also decided to correlate the outdoor data with data obtained by exposing similar specimens to artificially produced ozone in ozone chambers of the type originally described by Crabtree and Kemp (12) and subsequently adopted for use by the American Society for Testing Materials in a tentative standard (17) for measuring ozone resistance of rubber compounds. This type of equipment uses ozone concentrations of 25, 50, or possibly 100 pphm ozone, which together with elevated temperatures provides reasonable acceleration conditions for ozone attack on rubber. This method is in contrast to the method (18-19) used for corona testing of insulations in which up to 30,000 pphm ozone is stipulated.

Experimental Details

The work reported in this paper is divided into two parts. Part I covers 80 styrene-butadiene (SBR)[4] and 9 neoprene rubber compositions exposed in Los Angeles, Murray Hill, and Yuma and in the ozone chambers. As a matter of interest, several natural rubber compositions and single compounds of butyl and nitrile rubber were included. Both hot SBR and cold, oil-extended SBR polymers were tested. All contained carbon black, most contained some mineral filler, and some of the SBR compounds contained a relatively high quantity of asphaltic material. Except for the controls the compositions contained ozone resisting waxes, larger than normal quantities of antioxidants, and some of the materials now recognized as antiozonants, such as N,N′-dioctyl-paraphenylenediamine[5] and 6-ethoxy-1,2-dihydro-2,2,4-trimethylquinoline.[5] The base formulae are shown in Table 1 and the individual compounds in Appendix I.

The initial outdoor exposures began in June in Murray Hill and in July, 1954, in Los Angeles and Yuma. Observations on the Murray Hill and Los Angeles specimens are available for 18 months' exposure including two summer seasons, and exposure is continuing. Yuma exposures were terminated after 15 months including two summer seasons.

Previous information indicated that compounds exposed outdoors in the fall and winter seasons were more apt to survive without cracking than when the same compounds were exposed in the spring or summer seasons. In order to check this fact, duplicate panels of those exposed in June and July were exposed at Murray Hill and Los Angeles in November, 1954. Observations on these specimens are available for 18 months, but only one summer season is included. It should be noted that when the November exposure panels were assembled,

[4]ASTM Designation D1418-56T, American Society for Testing Materials, Philadelphia, Pa.
[5]See "Key to Appendices" for trade mark and supplier.

TABLE 1. COMPOUND FORMULAE

Styrene-Butadiene Rubber	Base A	Base B	Base C	Base D	Base E	Base F	Base G
SBR 1004 (hot)	100.0	—	100.0	—	25.0	—	—
1712 (cold oil-extended)	—	100.0	—	100.0	75.0	—	—
1503 (cold)	—	—	—	—	—	100.0	100.0
Pentizer	1.5	1.5	1.5	1.5	1.5	1.5	—
Tetramethylthiuram monosulfide	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Sulfur	2.0	2.0	4.0	4.0	4.0	2.0	4.0
Litharge	1.5	1.5	2.8	2.8	2.8	1.5	1.5
Zinc oxide	5.0	5.0	2.3	2.3	2.3	5.0	5.0
Clay	30.0	30.0	36.5	36.5	36.5	—	—
SRF Black	50.0	50.0	50.0	50.0	50.0	—	10.0
Mineral rubber	—	—	39.0	39.0	—	—	25.0
Phenyl-beta-naphthylamine, 65%, plus diphenyl-paraphenylene diamine*	—	—	0.4	0.4	0.4	—	—
Whiting	—	—	59.0	59.0	59.0	—	50.0
Asphaltic hydrocarbon†	—	—	—	—	41.0	—	22.0
Benzothiazyl disulfide	—	—	—	—	—	0.5	0.5
Light process oil	—	—	—	—	—	6.0	—
EPC black	—	—	—	—	—	30.0	—
FEF black	—	—	—	—	—	20.0	—
High styrene resin	—	—	—	—	—	—	25.0

Neoprene	Base H	Base I	Base J	Base K	Base L
Neoprene GN-A	100	100	100	100.0	100.0
Phenyl-beta-naphthylamine	2	2	2	2.0	2.0
SRF black	50	50	50	—	50.0
Magnesium oxide	3	—	—	4.6	4.0
Sulfur	1	—	—	—	—
Clay	40	—	40	37.0	50.0
Zinc oxide	4	—	—	10.0	5.0
Di-ortho-tolylguanidine	1	—	—	—	—
Light process oil	18	5	18	14.0	15.0
Red lead	—	20	20	—	—
Thermal black	—	—	—	—	50.0
Chemical plasticizer	—	—	—	0.4	0.3
Di-ortho-tolylguanidine salt of dicatechol borate‡	—	—	—	0.5	0.4
EPC black	—	—	—	43.0	—
Stearic acid	—	—	—	1.0	—

Natural Rubber	Base M	Base N
Smoked sheets	85.0	100.0
Pentizer	0.8	0.5
Whole tire reclaim	29.0	—
MPC black	27.0	—
SRF black	—	10.0
Zinc oxide	25.0	70.0
Sulfur	5.0	4.0
Tetramethylthiuram monosulfide	0.4	0.4
Di-ortho-tolylguanidine	0.2	0.2
Di-beta-naphthyl-paraphenylene-diamine§	1.0	1.0
Plasticizing oil	1.0	—
Phenyl-alpha-naphthylamine¶	1.4	—
Stearic acid	—	1.0
Mineral rubber	—	50.0

Nitrile Rubber	Base P
Hycar** 1001	100.0
Zinc oxide	5.0
Stearic acid	1.0
Tetramethylthiuram monosulfide	0.5
Dibutyl phthalate	15.0
Sulfur	2.0
FEF black	60.0

Butyl Rubber	Base Q	Base R	Base S	Base T	Base U
Enjay Butyl 325	100	—	100	—	—
215	—	100	—	—	—
035	—	—	—	100	—
150	—	—	—	—	100
Light process oil	12	—	—	—	—
Zinc oxide	5	5	5	5	5
Stearic acid	1	2	2	2	2
Sulfur	2	2	2	2	2
SRF black	60	—	—	—	—
p-Quinone dioxime	2	—	—	—	—
Benzothiazyl disulfide	4	—	—	—	—
FEF black	—	50	50	50	50
Tetramethylthiuram disulfide	—	1	1	1	1
Mercaptobenzothiazole	—	1	1	1	1

Unsaturations

Enjay Butyl 215—1.5-2.0 mole % unsaturation (referred to in text as 2½%)
325—2.1-2.5 mole % unsaturation (referred to in text as 3%)
035—0.6-1.0 mole % unsaturation (referred to in text as 1%)
150—1.0-1.4 mole % unsaturation (referred to in text as 2%)

*Akroflex CD, E. I. du Pont de Nemours & Co., Inc., trade mark.
†Gilsonite, Allied Asphalt & Mineral Corp. trade mark.
‡Permalux, Du Pont trade mark.
§AgeRite White, R. T. Vanderbilt Co. trade mark.
¶Neozone A, Du Pont trade mark.
**B. F. Goodrich Chemical Co. trade mark.

NOTE: The antioxidants shown in some formulations in this table are used in small enough quantities so that they function solely as antioxidants and not as antiozonants; thus they are not included under "Protective Agents—Other" in the appendices.

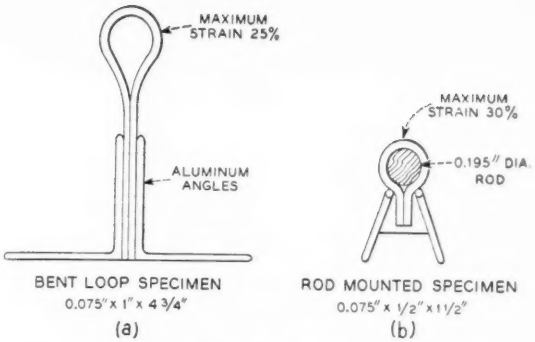


Fig. 4. Test specimens and methods of mounting

the sheets from which the specimens were prepared were at least six months old, and some had profuse brittle blooms which cracked and tended to flake off.

The indoor accelerated tests were run in chambers operating under three sets of conditions, i.e., chamber 1 at 110° F. with 25 pphm ozone, chamber 2 at 120° F. with 25 pphm ozone, and chamber 3 at 100° F. with 50 pphm ozone. Observations were made after 7 and 28 days' exposure.

Part II involved outdoor exposures at Murray Hill only, together with exposures in the three ozone chambers; the purpose was to fill in data on protective systems in SBR in order to make the materials picture more complete. Eighty-seven additional SBR compounds were investigated. Also, in order to correlate outdoor with chamber ozone cracking data for some of the other polymers, 17 natural rubber, 16 nitrile, and 60 butyl rubber compounds were tested.

These compounds contained protective agents similar to those used in the Part I SBR formulations which consisted of waxes, a higher-than-normal amount of an antioxidant (polymerized 1,2-dihydro-2-2,4-trimethylquinoline) as well as an antiozonant (N,N′-dioctylparaphenylenediamine). A dimethylnaphthalene-formaldehyde condensation product was also used in some of the butyl compounds. Most of the compounds studied in this paper were cured for 20 minutes at 307° F. For the few cases where other cure times were used, refer to the appendices. Observations are available for one year of outdoor exposure. Chamber data are available for seven and 28 days. Base formulas are shown in Table 1 and individual compounds in Appendix II.

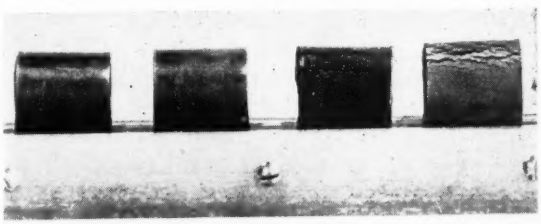


Fig. 5. Shown from left to right are bent-loop specimens illustrating the following degrees of ozone cracking: no cracking visible with a 7x glass; no cracking visible to the naked eye, but visible with a 7x glass; small cracks; large cracks

Specimens and Method of Rating

The Part I first and second outdoor exposures were made with 0.075-inch thick bent-loop specimens (20) in aluminum holders, as shown in Figure 4a. The calculated maximum strain in such specimens is approximately 25%. The Part I first-exposure chamber tests were made with ½-inch wide by 0.075-inch thick specimens wrapped on 0.195-inch rods, as shown in Figure 4b. The calculated strain in these specimens is approximately 30%. The rod-mounted specimens, when used indoors, were held on the rods with LEB binder clips (stationery items) and were quickly and easily prepared. When used outdoors, this method of clamping is unsatisfactory, and aluminum angles were used for clamping, as was the case with the bent-loop specimens.

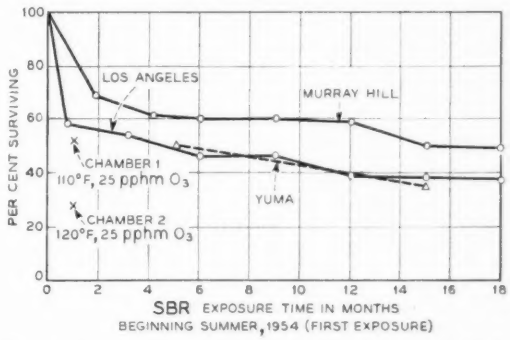


Fig. 6. % of SBR compounds remaining uncracked when exposed outdoors in Los Angeles, Yuma, Ariz.; and Murray Hill; exposure begun in the Summer of 1954

The Part I second-exposure chamber tests utilized bent-loop specimens as well as rod-mounted specimens in order to check the effects on cracking of the two different methods of mounting. With the compounds used in the Part I tests, about 12% more of the samples tested cracked when tested as rod-mounted than when tested as bent-loop specimens. The Part II outdoor and chamber specimens were all rod-mounted specimens.

Normally the exposed specimens are divided into four categories: namely, (1) those which show no cracks when examined under a 7x glass; (2) those which show no cracks when examined by the naked eye, but which do show cracks under a 7x glass; (3) those which have small cracks, perhaps not visible at a rapid glance, but which show up on careful scrutiny; and (4) those which have large cracks that project considerably into the thickness of the specimen.

Figure 5 illustrates the categories or ratings mentioned in the preceding paragraph. All specimens which show ozone cracking, even when viewed under a 7x glass, are normally rated as failures. Since the outdoor tests in this case are of long duration and there is some possibility that imperfections observed with a 7x glass may be due to crazing of blooms or of oxidized skins, however, it was decided to rate specimens as being uncracked when they developed no ozone cracking visible after careful examination by the naked eye. Such speci-

mens showing no cracks to the naked eye are listed in the tables as "specimens which do not crack" and are designated by "0" in the appendices.

Experimental Results, Part I

The results of the SBR outdoor exposure tests are shown in Tables 2 and 3, and curves showing the percentage of specimens surviving uncracked outdoors are shown in Figures 6 and 7. As noted previously, the uncracked specimens showed no ozone cracking when carefully viewed with the naked eye. Surface checking due to ultra-violet induced oxidation was not considered as ozone cracking.

TABLE 2. CORRELATION OF 18-MONTH SBR LOS ANGELES AND MURRAY HILL OUTDOOR EXPOSURE DATA

	First Exposure	Second Exposure
% Specimens which		
(1) Do not crack in L.A.	37	39
(2) Do not crack in M.H.	49	35
(3) Do not crack in L.A. and M.H.	37	31
(4) Do not crack in L.A., but crack in M.H.	0	8
(5) Do not crack in M.H, but crack in L.A.	12	4
% Specimens which do not crack outdoors in the first and second exposures		28

Notes:
1. "Specimens which do not crack" means no cracks visible to naked eye in Tables 2-11.
2. First exposure begun in the Summer of 1954.
3. Second exposure begun in Nov., 1954.
4. Eighteen months includes two summers in the first exposure, but only one summer in the second exposure.
5. Eighty compounds included in these exposures.

TABLE 3. CORRELATION OF 15-MONTH SBR YUMA, LOS ANGELES, AND MURRAY HILL OUTDOOR EXPOSURE DATA

% Specimens which:	
(1) Do not crack in Yuma	35
(2) Do not crack in M.H.	50
(3) Do not crack in L.A.	39
(4) Do not crack in Yuma, M.H., and L.A.	29
(5) Do not crack in Yuma and M.H.	31
(6) Do not crack in Yuma and L.A.	29
(7) Do not crack in M.H. and L.A.	37

Notes:
1. Exposure begun in the Summer of 1954.
2. Fifteen months includes two summers.
3. Eighty compounds included in these exposures.

For the tests initiated in the summer, the Los Angeles exposure had 39% of the specimens surviving uncracked after 15 months' exposure; the Yuma exposure had 35% surviving, and the Murray Hill exposure had 50% surviving. The majority of cracking occurred in the first and second exposure months, June and July for the Murray Hill exposure and July and August for the Yuma and Los Angeles exposures.

Whether the specimens were exposed in summer or fall in Los Angeles had essentially no effect on the percentage of uncracked specimens remaining after 18 months of exposure; 37% remained uncracked from the summer initiated exposure and 39% from the November initiated exposure. This point is not true for the two exposures in New Jersey, however, where the exposure made in June resulted in more uncracked specimens than the November exposure, 49 *versus* 35% after 18 months of exposure. After 10 months, the second Murray Hill exposure checks very well with the results of both the July and the November Los Angeles exposures.

Whereas the percentage surviving curves for the summer exposures at Los Angeles and Murray Hill have similar shapes even though the values for Los Angeles are somewhat lower, the shapes of the corresponding survival curves for the November exposures are somewhat different for the two locations. Ninety per cent. of the Murray Hill specimens survived the winter months of November through February, while less than 70% survived through the winter at Los Angeles. Low ozone concentrations and, perhaps, heavier blooms during the colder winter weather in New Jersey, reduced ozone attack. The rate of cracking in Murray Hill increased in March, and at the end of 10 months' exposure the percentage surviving was similar for the two locations.

In each of the summer-initiated and the November-initiated Murray Hill and Los Angeles exposures, 12% of the specimens did not respond the same, some cracked in Murray Hill and not in Los Angeles, and some in Los Angeles and not in Murray Hill.

TABLE 4. CORRELATION OF SBR OZONE CHAMBER DATA

	Weeks Exposed	
First Exposure (Specimens One Week Old)	1	4
% Specimens which:		
(1) Do not crack in Chamber 1 (110° F., 25 pphm O_3)	60	52
(2) Do not crack in Chamber 2 (120° F., 25 pphm O_3)	48	28
(3) Do not crack in Chambers 1 and 2	46	27
(4) Do not crack in Chamber 1, but crack In 2	14	25
(5) Do not crack in Chamber 2, but crack in 1	2	1
Second Exposure (Specimens Six Months Old)		
% Specimens which:		
(1) Do not crack in Chamber 1 (110° F., 25 pphm O_3)	39	33
(2) Do not crack in Chamber 2 (120° F., 25 pphm O_3)	26	17
(3) Do not crack in Chamber 3 (100° F., 50 pphm O_3)	21	19
(4) Do not crack in Chambers 1, 2, and 3	11	11
(5) Do not crack in Chambers 1 and 2, but crack in 3	12	5
(6) Do not crack in Chambers 1 and 3, but crack in 2	4	5
(7) Do not crack in Chambers 2 and 3, but crack in 1	0	0
(8) Do not crack in Chamber 1, but crack in 2 and 3	14	14
(9) Do not crack in Chamber 2, but crack in 1 and 3	1	1
(10) Do not crack in Chamber 3, but crack in 1 and 2	1	1
Overall Results		
% Specimens which do not crack in the chambers in the first and second exposures.	11	9

Note: 80 compounds included in these exposures.

A correlation of the ozone chamber data is presented in Table 4, and curves showing the percentage specimens surviving uncracked in each chamber are shown in Figure 8. The specimens which were approximately one week old when tested were more crack resistant than the six-month-old specimens of the same materials. The increase in bloom on some of the specimens to the point where the blooms were brittle, perhaps accounts for this difference. The 120° F., 25 pphm ozone chamber exposures resulted in more cracking than the 110° F., 25 pphm ozone chamber exposures. Exposing the specimens

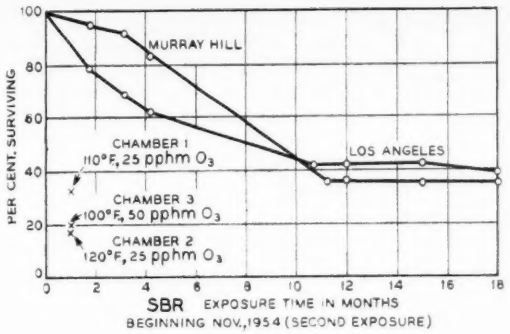


Fig. 7. % of SBR compounds remaining uncracked when exposed outdoors in Los Angeles, and Murray Hill; exposure begun in November, 1954

to 50 pphm ozone at 100° F. had about the same effect as exposing them to 25 pphm ozone at 120° F. Most of the cracked specimens developed cracks in the first week, but some specimens survived the first week and cracked prior to the expiration of one month.

The outdoor information of Table 2 and the chamber data of Table 4 are combined in Tables 5 and 6 for ease of comparison of the Los Angeles and Murray Hill outdoor results with the chamber results. Figures 6 and 7 showing the outdoor results have the ozone chamber results spotted on them. It is apparent that the first 110° F., 25 pphm ozone chamber 1 test agrees fairly well with the first outdoor Murray Hill results, but this same chamber test was not severe enough in causing specimen cracking to predict all the L. A. cracking.

Chamber 2, first exposure, operating at 120° F., 25 pphm ozone, had fewer survivors than either Murray Hill or Los Angeles after 18 months so that it might be described as being too severe. But it is quite possible that the chamber and outdoor values will correlate more closely as the time of outdoor exposure increases beyond 18 months.

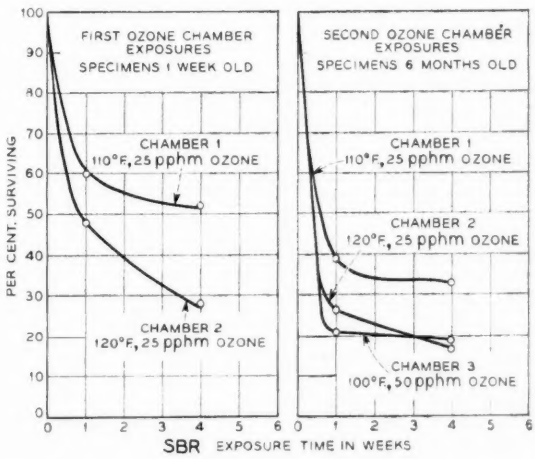


Fig. 8. % of SBR compounds remaining uncracked when exposed to 25 and 50 pphm ozone at elevated temperatures

In the case of the specimens which were six months old at the time of exposure, chamber 1 operating at 110° F., 25 pphm ozone, resulted in about the same percentage of uncracked specimens as the second 18-month exposures outdoors at Murray Hill and at Los Angeles. Chambers 2 and 3 operated at 120° F., 25 pphm ozone and 100° F., 50 pphm ozone, both resulted in excessive percentage specimens cracked when compared to the outdoor 18-month results at Murray Hill and Los Angeles, but again it is quite possible that these values may correlate more closely as time of outdoor exposure increases.

Examination of the data indicates that, on the average, 25% of the specimens do not behave the same when exposed in one of the chambers and when exposed out-

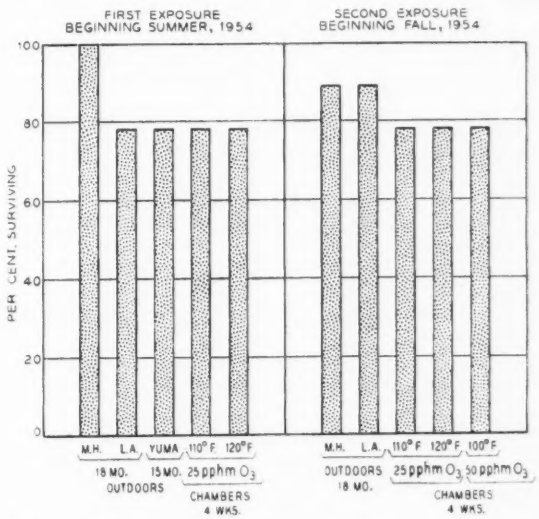


Fig. 9. % of neoprene compounds remaining uncracked when exposed outdoors at Murray Hill and in ozone chambers

doors, i.e., some of the specimens which crack in the chamber do not crack outdoors and, *vice versa*, some of the specimens which crack outdoors do not crack in the chamber. The 25% value is obtained by averaging the sums of items 4 and 5 for each chamber for both the first and the second exposures in Tables 5 and 6.

The neoprene compounds with the exception of a waxless compound and a 3-phr paraffin compound withstood all outdoor tests without cracking. The no-wax compound did not crack in the first exposure at Murray Hill and in the 100° F., 50 pphm ozone chamber test, but cracked in all other chamber and outdoor tests. The 3-phr paraffin compound cracked in all the chamber tests and outdoors in Los Angeles, first test, and at Yuma, but did not crack in the other outdoor tests. The neoprene data are summarized in Table 7 and in Figure 9.

Experimental Results, Part II

As previously noted, this second part of the study involved exposing additional compounds outdoors only at Murray Hill and in the ozone chambers; the main

purpose was to fill in the materials study and to correlate chamber and outdoor ozone effects for natural, nitrile, and butyl rubber compounds.

TABLE 5. CORRELATION OF 18-MONTH SBR LOS ANGELES OUTDOOR EXPOSURE DATA WITH ONE-MONTH OZONE CHAMBER DATA

	First Exposure	Second Exposure
Los Angeles Compared to Chamber 1 (110° F., 25 pphm O_3)		
% Specimens which:		
(1) Do not crack in L.A.	37	39
(2) Do not crack in Chamber 1	52	33
(3) Do not crack in L.A. and Chamber 1	31	27
(4) Do not crack in L.A., but crack in Chamber 1	6	12
(5) Do not crack in Chamber 1, but crack in L.A.	21	6
Los Angeles Compared to Chamber 2 (120° F., 25 pphm O_3)		
% Specimens which:		
(1) Do not crack in L.A.	37	39
(2) Do not crack in Chamber 2	28	17
(3) Do not crack in L.A. and Chamber 2	23	13
(4) Do not crack in L.A., but crack in Chamber 2	14	26
(5) Do not crack in Chamber 2, but crack in L.A.	5	4
Los Angeles Compared to Chamber 3 (100° F., 50 pphm O_3)		
% Specimens which:		
(1) Do not crack in L.A.	—	39
(2) Do not crack in Chamber 3	—	19
(3) Do not crack in L.A. and Chamber 3	—	15
(4) Do not crack in L.A., but crack in Chamber 3	—	24
(5) Do not crack in Chamber 3, but crack in L.A.	—	4

Notes:
1. First outdoor exposure begun in the Summer of 1954.
2. Second outdoor exposure begun in Nov. 1954.
3. First exposure chamber specimens one week old at time of exposure.
4. Second exposure chamber specimens six months old at time of exposure.
5. Eighty compounds included in these exposures.

NATURAL RUBBER. The two natural rubbers included in the Part I exposures cracked in all chamber tests and in all outdoor exposures. An additional 13 natural rubber compounds were prepared using 6 and 9 phr of various waxes, with and without 3 phr of an antioxidant (polymerized 1,2-dihydro-2,2,4-trimethylquinoline).[5] All of these compounds cracked outdoors at Murray Hill within 24 days; the initial exposures were made in April of 1955. Likewise, all of these compounds with the exception of two, cracked in the three ozone chambers operating at: (1) 110° F., 25 pphm ozone; (2) 120° F., 25 pphm ozone, and (3) 100° F., 50 pphm ozone. The first exception did not crack in the 110 and the 120° F. chambers, but cracked in the 100° F. chamber; while the second exception did not crack in the 120° F. chamber, but cracked in the 100 and 110° F. chambers.

An additional group of four natural rubber compounds containing 0, 1, 2, and 3 phr of N,N′-dioctyl-paraphenylenediamine[5] and 6 phr of wax cracked outdoors at Murray Hill within four months; the initial exposures were made in February, 1956. The antiozonant in all three concentrations prolonged for several months the times for outdoor crack initiation. The antiozonant had no effect on the chamber specimens as all cracked in the usual exposure time.

TABLE 6. CORRELATION OF 18-MONTH SBR MURRAY HILL OUTDOOR EXPOSURE DATA WITH ONE-MONTH OZONE CHAMBER DATA

	First Exposure	Second Exposure
Murray Hill Compared to Chamber 1 (110° F., 25 pphm O_3)		
% Specimens which:		
(1) Do not crack in M.H.	49	35
(2) Do not crack in Chamber 1	52	33
(3) Do not crack in M.H. and Chamber 1	39	20
(4) Do not crack in M.H., but crack in Chamber 1	10	15
(5) Do not crack in Chamber 1, but crack in M.H.	13	13
Murray Hill Compared to Chamber 2 (120° F., 25 pphm O_3)		
% Specimens which:		
(1) Do not crack in M.H.	49	35
(2) Do not crack in Chamber 2	28	17
(3) Do not crack in M.H. and Chamber 2	28	11
(4) Do not crack in M.H., but crack in Chamber 2	21	24
(5) Do not crack in Chamber 2, but crack in M.H.	0	6
Murray Hill Compared to Chamber 3 (100° F., 50 pphm O_3)		
% Specimens which:		
(1) Do not crack in M.H.	—	35
(2) Do not crack in Chamber 3	—	19
(3) Do not crack in M.H. and Chamber 3	—	13
(4) Do not crack in M.H., but crack in Chamber 3	—	22
(5) Do not crack in Chamber 3, but crack in M.H.	—	6

Notes:
1. First outdoor exposure begun in the Summer of 1954.
2. Second outdoor exposure begun in Nov., 1954.
3. First exposure chamber specimens one week old at time of exposure.
4. Second exposure chamber specimens six months old at time of exposure.
5. Eighty compounds included in these exposures.

TABLE 7. CORRELATION OF NEOPRENE OUTDOOR EXPOSURE DATA WITH OZONE CHAMBER DATA

Exposure Location or Conditions	Specimen Age at Time of First Exposure	% Uncracked Specimens in 1 Mo.	1 Yr.	15 Mos.	18 Mos.
Outdoors @:					
Los Angeles	1 mo.	—	78	78	78
Murray Hill	1 mo.	—	100	100	100
Yuma	1 mo.	—	—	78	—
Chamber @:					
110° F., 25 pphm O_3	1 wk.	78	—	—	—
120° F., 25 pphm O_3	1 wk.	78	—	—	—
Outdoors @:					
Los Angeles	6 mos.	—	89	89	89
Murray Hill	6 mos.	—	89	89	89
Chamber @:					
110° F., 25 pphm O_3	6 mos.	78	—	—	—
120° F., 25 pphm O_3	6 mos.	78	—	—	—
100° F., 50 pphm O_3	6 mos.	78	—	—	—

Notes:
1. First outdoor exposure begun in the Summer of 1954.
2. Second outdoor exposure begun in Nov., 1954.
3. Nine compounds included in these exposures.

NITRILE RUBBER. The Part I exposures included one nitrile rubber which cracked in all chamber and outdoor exposures. An additional 12 nitrile compounds were prepared using 6 and 9 phr of three different waxes, with and without 3 phr of an antioxidant (polymerized 1,2-dihydro-2,2,4-trimethylquinoline).[5] All of these compounds cracked outdoors at Murray Hill within 24 days; the initial exposures were made in April, 1955, and all

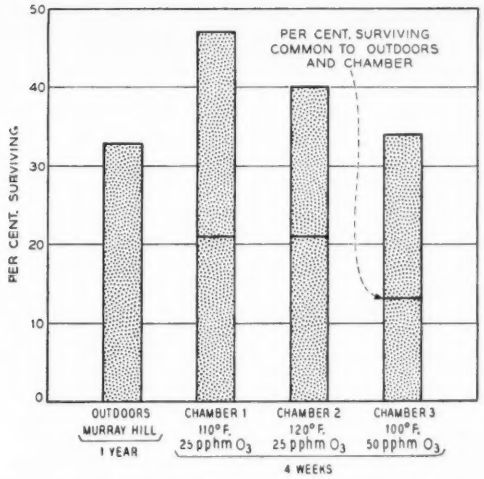


Fig. 10. % of SBR compounds remaining uncracked when exposed outdoors at Murray Hill and in ozone chambers

cracked in the three ozone chambers. Four added nitrile compounds containing 0, 1, 2, and 3 phr of N,N′-dioctyl-paraphenylenediamine[5] and 6 phr of wax cracked outdoors at Murray Hill within two months; the initial exposures were in February, 1956. The compound with 3 phr of antiozonant remained uncracked in the chambers; while the others cracked in all three chambers. Nitrile and natural rubber results are tabulated in Table 8.

TABLE 8. CORRELATION OF OUTDOOR EXPOSURE DATA FOR NATURAL RUBBER AND NITRILE COMPOSITIONS WITH OZONE CHAMBER DATA

Polymer	Exposure Location or Conditions	% Uncracked Specimens in 1 Mo.	% Uncracked Specimens in 4 Mos.
Natural rubber (19 compounds)	Outdoors @: Murray Hill	—	0
	Chamber @: 110° F., 25 pphm O_3	5	—
	120° F., 25 pphm O_3	11	—
	100° F., 50 pphm O_3	0	—
Nitrile (17 compounds)	Outdoors @: Murray Hill	—	0
	Chamber @: 110° F., 25 pphm O_3	6	—
	120° F., 25 pphm O_3	6	—
	100° F., 50 pphm O_3	6	—
	Specimen age at time of: (1) Chamber exposure	1 week	
	(2) Outdoor exposure	1 month	

SBR. Eighty-seven additional SBR compositions were prepared and tested outdoors at Murray Hill and in the chambers. Most of these compositions contained 3 to 9 phr of various waxes and 2 to 5 phr of various antioxidants. Chambers 1 and 2, operated at 25 pphm ozone and 110 and 120° F., respectively, did not cause cracking in as many specimens as did outdoor exposure for one year. Statistically, the 50 pphm, 100° F. chamber predicted 34% uncracked specimens *versus* 33% outdoors, but on analysis of the individual compounds, only 13% did not crack in both exposures. Possible reasons for this lack of correlation are given in the discussion.

The data are summarized in Table 9 and graphed in Figure 10.

TABLE 9. CORRELATION OF ONE-YEAR SBR MURRAY HILL OUTDOOR EXPOSURE DATA WITH ONE-MONTH OZONE CHAMBER DATA

Murray Hill Compared to Chamber 1 (110° F., 25 pphm O_3)	
% Specimens which:	
(1) Do not crack in M.H.	33
(2) Do not crack in Chamber 1	47
(3) Do not crack in M.H. and Chamber 1	21
(4) Do not crack in M.H., but crack in Chamber 1	12
(5) Do not crack in Chamber 1, but crack in M.H.	26
Murray Hill Compared to Chamber 2 (120° F., 25 pphm O_3)	
% Specimens which:	
(1) Do not crack in M.H.	33
(2) Do not crack in Chamber 2	40
(3) Do not crack in M.H. and Chamber 2	21
(4) Do not crack in M.H., but crack in Chamber 2	12
(5) Do not crack in Chamber 2, but crack in M.H.	19
Murray Hill Compared to Chamber 3 (100° F., 50 pphm O_3)	
% Specimens which:	
(1) Do not crack in M.H.	33
(2) Do not crack in Chamber 3	34
(3) Do not crack in M.H. and Chamber 3	13
(4) Do not crack in M.H., but crack in Chamber 3	20
(5) Do not crack in Chamber 3, but crack in M.H.	21

Notes:
1. Outdoor exposure begun in Apr., 1955.
2. Chamber specimens one week old at time of exposure.
3. Outdoor specimens one month old at time of exposure.
4. Eighty-seven compounds included in these exposures.

Included in this group of SBR compositions were 30 compounds made with hot SBR 1004 and 30 similar compounds made with cold, oil-extended SBR 1712. The cracking statistics for these compounds are shown in Table 10 and in Figure 11. It can be seen that the two SBR types reacted to outdoor ozone at Murray Hill in about the same manner, but in the chambers a greater percentage of cracked specimens was obtained with the hot than with the cold, oil-extended rubber.

Perhaps the protective agents were more soluble in the non-oil rubber than in the oil-containing rubber, or the rate of bloom formation was slower for the non-oil rubber. If the latter were true, the outdoor specimens were more resistant to ozone attack than the chamber specimens because a heavier bloom had formed on the outdoor specimens which were one month old at the

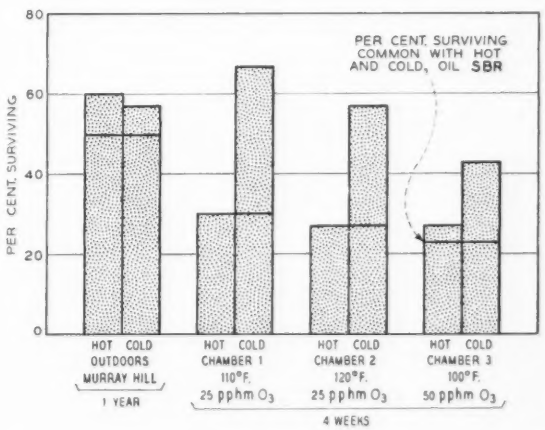


Fig. 11. Ozone resistance of hot vs. cold oil-extended SBR compounds

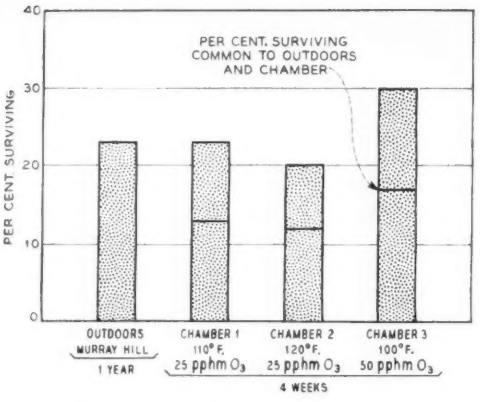


Fig. 12. Ozone resistance of compounds containing butyl rubbers having 1, 2, 2½ and 3% unsaturation

time of exposure, compared to the chamber specimens which were one week old.

TABLE 10. OZONE RESISTANCE OUTDOORS AT MURRAY HILL AND IN THE OZONE CHAMBERS OF HOT VS. COLD, OIL-EXTENDED SBR

	% Uncracked		
Exposure Location or Conditions	Hot SBR 1004	Cold, Oil-Extended SBR 1712	Common*
Outdoors at Murray Hill, 1 yr.	60	57	50
Chamber 1, 110° F., 25 pphm O_3, 1 mo.	30	67	30
Chamber 2, 120° F., 25 pphm O_3, 1 mo.	27	57	27
Chamber 3, 100° F., 50 pphm O_3, 1 mo.	27	43	23

*"Common" indicates the percentage of compounds which do not crack when made with hot or cold SBR.
Notes:
1. Outdoor exposure begun in Apr., 1955.
2. Chamber specimens one week old at time of exposure.
3. Outdoor specimens one month old at time of exposure.
4. Thirty SBR 1004 compounds and 30 SBR 1712 duplicates included in these exposures.

BUTYL. The butyl rubber compound included in Part I cracked in all chamber and outdoor exposures. Sixty additional butyl compounds were prepared using 15 protective systems in butyl rubbers of 1, 2, 2½, and 3% unsaturation. The protective agents consisted of 3 and 6 phr of four different waxes; 3 and 6 phr of a wax-antiozonant (N,N′-dioctyl-paraphenylenediamine)[5] combination; 1, 2, and 3 phr of this antiozonant without wax; and 10 and 20 phr of a dimethyl naphthalene-formaldehyde condensation product.[5]

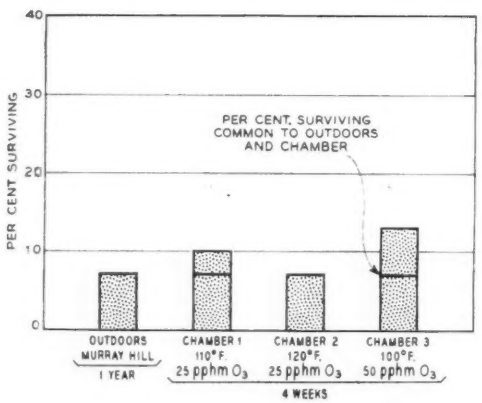


Fig. 13. Ozone resistance of compounds containing butyl rubbers having 2½ and 3% unsaturation

TABLE 11. CORRELATION OF ONE-YEAR MURRAY HILL OUTDOOR EXPOSURE BUTYL DATA WITH 1-MONTH OZONE CHAMBER DATA

Murray Hill Compared to Chamber 1 (110° F., 25 pphm O_3)	
% Specimens which:	
(1) Do not crack in M.H.	2[illegible]
(2) Do not crack in Chamber 1	23
(3) Do not crack in M.H. and Chamber 1	13
(4) Do not crack in M.H., but crack in Chamber 1	10
(5) Do not crack in Chamber 1, but crack in M.H.	10
Murray Hill Compared to Chamber 2 (120° F., 25 pphm O_3)	
% Specimens which:	
(1) Do not crack in M.H.	23
(2) Do not crack in Chamber 2	20
(3) Do not crack in M.H. and Chamber 2	12
(4) Do not crack in M.H. but crack in Chamber 2	11
(5) Do not crack in Chamber 2, but crack in M.H.	8
Murray Hill Compared to Chamber 3 (100° F., 50 pphm O_3)	
% Specimens which:	
(1) Do not crack in M.H.	23
(2) Do not crack in Chamber 3	30
(3) Do not crack in M.H. and Chamber 3	17
(4) Do not crack in M.H., but crack in Chamber 3	6
(5) Do not crack in Chamber 3, but crack in M.H.	13

Notes:
1. Outdoor exposure begun in June, 1955.
2. Chamber specimens one week old at time of exposure.
3. Outdoor specimens one month old at time of exposure.
4. Sixty compounds included in these exposures.

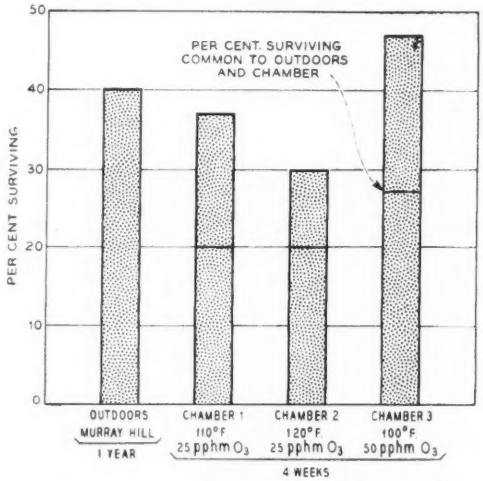


Fig. 14. Ozone resistance of compounds containing butyl rubbers having 1% and 2% unsaturation

The data in Table 11 and in Figure 12 show that 23% of the specimens survived outdoors at Murray Hill for one year without cracking. This compares to 23, 20, and 30% survivors, respectively, in the chambers operating at: (1) 110° F., 25 pphm ozone; (2) 120° F., 25 pphm ozone, and (3) 100° F., 50 pphm ozone. On an average, 10% cracked in any one chamber, but did not crack outdoors, and, likewise, 10% cracked outdoors and not in any one chamber.

On analysis of the butyl compounds in Appendix II (compounds 121-180), it is seen that the 2½ and 3%

unsaturated butyls showed good correlation between outdoor and ozone chamber cracking with 93% of the compounds in agreement. The 1% and 2% unsaturated butyl compounds, on the other hand, did not exhibit this uniformity of results, as only 50% of these compounds showed agreement among the results in all the chambers and outdoors. The % surviving data are shown in Figure 13 for the 2½ and 3% unsaturated butyl compounds and in Figure 14 for the 1% and 2% unsaturated butyl compounds.

Other tests, the results of which are not included in Table 11, showed that doubling the curing times of the unprotected 1, 2, 2½, and 3% unsaturated butyl compounds from 20 to 40 minutes at 307° F. did not prevent these compounds from cracking in the 120° F., 25 pphm ozone chamber and outdoors.

Discussion of Results

It is not surprising that perfect or near-perfect correlation of exposure data seldom is found when one considers the effects of variable conditions which exist from one exposure to another. For instance, the specimens in the three outdoor locations aside from being subjected to different ozone concentrations were subjected to different ultra-violet concentrations, to different temperature, rain, frost, snow, and surface dirt conditions. The chamber specimens were subjected to three different temperatures, and temperature affects the solubility of the bloom constituents in the compound and thereby regulates the amount of bloom.

The chamber specimens being in the dark were not subject to light energized oxidation as were the outdoor specimens. The oxidized skins produced on some rubbers, when exposed outdoors, are thought to reduce the tendency to ozone crack. The age of the specimen at the time of exposure and other factors affect the amount of bloom. Relaxation of stress within specimens is undoubtedly different in one-month chamber tests operating at elevated temperatures, compared to the normally longer and often cooler outdoor exposures.

A polymer such as neoprene, which is readily protected from outdoor ozone cracking by means of protective wax, generally correlates well with ozone chamber data, and, likewise, polymers such as natural and nitrile rubber which are difficult to protect from outdoor ozone cracking also correlate well with ozone chamber data. SBR with protective agents, on the other hand, appears to fall somewhere between these other types of polymers in resistance to outdoor ozone, and correlation with chamber data is not as good.

The butyl rubbers of highest unsaturation tend to be difficult to protect from outdoor cracking and fall in line with the natural rubber and nitrile stocks in showing good correlation between outdoor and chamber results. The compounds of the more saturated butyls which contain protective agents tend to resist outdoor cracking, and like the protected SBR compounds, do not correlate so well with the chamber data.

Summary and Conclusions

For the series of SBR specimens initially exposed in the Summer of 1954, exposure in Los Angeles and in Yuma resulted in a greater percentage of ozone cracked specimens than exposure in Murray Hill. This condition was not true, however, for the same series of specimens when exposure was initiated in November. In this case the Los Angeles and Murray Hill exposures resulted in about the same percentage of cracked specimens and checked with the results of the earlier Los Angeles exposure. Thus it appears that cracking of statically exposed rubber compounds can occur in Murray Hill and in Yuma to the same extent as in Los Angeles, given sufficient time of exposure.

The ozone chamber operating at 110° F., 25 pphm ozone, resulted in a lesser number of cracked SBR specimens than the chambers operating at 120° F., 25 pphm ozone, and 100° F., 50 pphm ozone; the latter two chambers had about the same effect. Exposure of both one-week- and six-month-old SBR specimens in the ozone chambers resulted in a greater percentage of cracked specimens among the older specimens. The 110° F. ozone chamber test on the six-month-old specimens correlated well with the outdoor agings at Los Angeles and Murray Hill; while the 120 and 100° F. chambers resulted in a higher number of cracked specimens than obtained outdoors. It may be, however, that continued exposure of outdoor specimens will bring the correlation of outdoor and 120 and 100° F. chamber specimens closer together.

The neoprenes, the natural rubbers, and the nitrile rubbers showed good correlation among ozone chambers and on outdoor exposure. The neoprene compositions, when protected by wax (other than paraffin), remained uncracked in the chambers and outdoors. The natural and nitrile rubber compositions were not resistant to cracking in the chambers or outdoors.

The 2½ and 3% unsaturated butyl compounds also showed good correlation among chambers and on outdoor exposure; all specimens cracked except those protected with a combination of wax and N,N′-dioctyl-paraphenylenediamine.[5] The 1% and 2% unsaturated butyl formulations likewise resisted cracking when compounded with this same combination of protective agents, and, in addition, waxes alone offered some protection. The 1% and 2% unsaturated butyl compositions showed less correlation between chamber and outdoor results than the 2½ and 3% unsaturated butyls.

As one would expect, all of the unprotected SBR compounds cracked in all chamber and outdoor tests. Six SBR formulations containing between 6 and 8 phr of wax for ozone protection survived all outdoor tests. They represent 12% of the wax-containing compounds.

Antioxidants such as quinoline derivatives, diphenyl-paraphenylenediamine, and a reaction product of acetone and diphenylamine, when used in SBR in higher proportions than normal and without wax, gave no protection against cracking; but when used with wax, 26 compounds, representing 34% of these mixtures, survived outdoors. Thus, combinations of 3 to 5 phr of antioxidants such as these with 3 to 6 phr of wax impart greater ozone resistance to SBR than wax alone.

Three SBR compounds containing N,N′-dioctyl-para-

phenylenediamine and no wax survived all outdoor exposures, and three similarly protected SBR compounds survived some, but not all outdoor exposures. Most of the SBR compounds containing mixtures of this antiozonant with wax in ratios of 1 phr of the diamine to 5 of wax or of 2 phr of the diamine to 3 of wax survived all outdoor exposures. The use of such mixtures in SBR appears to be the most reliable way of obtaining protection against static outdoor ozone cracking.

Acknowledgment

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Appendices

Key to Appendices—Protective Agents

WAXES

a. Sun Wax 4415 (Sun Oil Co. trade mark).
b. Sunolite #127 (Witco Chemical Co. trade mark).
c. Heliozone (E. I. du Pont de Nemours & Co., Inc. trade mark).
d. Herron #24 (Herron Bros. & Meyer trade mark).
e. Sunproof Super (Naugatuck Chemical Division, United States Rubber Co. trade mark).
f. Paraffin.
g. Shell MX-165 (Shell Oil Co. trade mark).
h. AA 1177 (Allied Asphalt & Mineral Corp. trade mark).
i. AA #8—wax in wax-asphalt mixture (Allied Asphalt & Mineral Corp. trade mark).
j. AA #9—wax in wax-asphalt mixture (Allied asphalt & Mineral Corp. trade mark).

OTHER

k. Polymerized 1, 2-dihydro-2, 2, 4-trimethylquinoline (AgeRite Resin D, R. T. Vanderbilt Co. trade mark).
m. 6-Ethoxy-1, 2-dihydro-2, 2, 4-trimethylquinoline (Santoflex AW, Monsanto Chemical Co. trade mark).
n. Phenyl-alpha-naphthylamine (Neozone A, du Pont trade mark).
p. 65% phenyl-beta-naphthylamine, 35% diphenyl-paraphenylenediamine (Akroflex CD, du Pont trade mark).
q. Reaction product of acetone and diphenylamine (BLE, Naugatuck Chemical, U. S. Rubber, trade mark).
r. N, N'dioctyl-paraphenylenediamine (UOP 88, Universal Oil Products Co trade mark).
s. Dimethyl naphthalene-formaldehyde condensation product (Kenflex A, Kenrich Corp. trade mark).
t. Nickel dibutyl dithiocarbamate (NBC, du Pont trade mark).
u. Furane derivative A (Furatone 1444, Irvington Varnish Co. trade mark).
v. Furane derivative B (Furatone 1547, Irvington Varnish trade mark).
w. Furane derivative C (Furatone 1444A, modified to prevent remassing, Irvington Varnish trade mark).

Appendix I

PART I OZONE CHAMBER AND OUTDOOR DATA

Columns numbered 1 below represent first exposure.
Columns numbered 2 below represent second exposure.
"0" indicates that specimens had no cracks visible to the naked eye.
See Table 1 for base compound key.

Sample No.	Base Compound	Protection		0_3 Chambers (1 Mo.)					Outdoors				
		Wax	Other	110° F. 25 pphm		120° F. 25 pphm		100° F. 50 pphm	L.A. 18 Mos.		M.H. 18 Mos.		Yuma 15 Mos.
		Phr		1	2	1	2	2	1	2	1	2	1
1	A	—	3k										
2	(Hot	3a	3k	0	0	0	0	0	0	0	0	0	
3	SBR)	—	2m										
4		3a	2m	0	0	[illegible]		0					
5		—	5u										
6		3a	5u										
7		—	5v										
8		3a	5v										
9		—	5w										
10		3a	5w										
11		6b	—	0							0		
12		—	5n										
13		3a	5n										
14		—	5p										
15		3a	5p	0			0		0		0	0	
16		—	5q		0								
17		3a	5q	0	0			0		0		0	
18		—	—										
19		3a	—										
20		6a	—										
21		6c	—	0									
22		6d	—	0	0	0	0		0	0	0	0	0
23		3a	3m	0	0		0						
24		3a	5m	0	0								
25		—	2r						0		0	0	
26		3d	2r	0					0	0	0	0	0
27		—	—										

Note: All compounds cured 20 minutes at 307° F. except:
Compound 88 cured 14 minutes;
Compounds 90 and 91 cured 10 minutes;
Compounds 92 and 93 cured 30 minutes.

Sample No.	Base Compound	Protection: Wax (Phr)	Protection: Other (Phr)	0_3 Chambers (1 Mo.): 110° F. 25 pphm 1	110° F. 25 pphm 2	120° F. 25 pphm 1	120° F. 25 pphm 2	100° F. 50 pphm	Outdoors: L.A. 18 Mos. 1	L.A. 18 Mos. 2	Outdoors: M.H. 18 Mos. 1	M.H. 18 Mos. 2	Yuma 15 Mos. 1
28	B	3a	3k	0									
29	(Cold	—	5k										
30	Oil-	3a	5q	0				0					
31	Extended	3a	5p	0									
32	SBR)	3a	—										
33		5a	—										
34		3a	3q	0									
35		6c	—		0								
36		8c	—	0									
37		6d	—	0					0		0		0
38		8d	—	0					0	0	0	0	0
39		6b	—										
40		8b	—										
41		3d	3p	0		0			0	0	0	0	0
42		3d	—										
43		3d	3q	0					0	0	0	0	0
44		3d	3m	0		0					0	0	0
45		3d	3k	0			0		0	0	0	0	0
46		3e	—								0		
47		6e	—	0		0			0	0	0	0	0
48		8e	—	0	0	0	0	0	0	0	0	0	0
49		—	2r		0				0	0	0	0	
50		3d	2r	0	0	0	0	0	0	0	0	0	0
51		—	—										
52	C	—	—										
53	(Hot	—	2r	0	0	0		0		0	0	0	
54	SBR)	3a	2r	0	0	0		0	0	0	0	0	
55		9h	—	0	0	0		0	0	0	0		0
56		6h	—								0		
57	D	—	—										
58	(Cold	—	2r		0	0		0	0	0	0	0	0
59	Oil-	3a	2r	0	0	0	0		0	0	0	0	0
60	Extended	9h	—	0	0	0			0	0	0		0
61	SBR)	6h	—	0					0	0	0		0
62		6.5i	—	0	0	0	0	0	0	0	0	0	0
63		6.5j	—	0	0	0	0	0	0	0	0	0	0
64	E	5.8c 3.8f	—										
65	(25% Hot, 75% Cold	9.6d 2.7c 3.8f	—								0		0
66	SBR)	5.8c 3.8f	3k	0	0	0	0	0		0	0		0
67		5.8c 3.8f	3m	0	0	0	0	0			0		
68		5.8c 2.7f 2.7c	3p	0	0					0	0		
69		9.6d 3.8f	3k						0	0	0	0	0
70		2.7c 9.6d 3.8f	3m	0	0	0	0		0	0	0	0	0
71		2.7c 9.6d 3.8f	3p		0		0		0	0	0		0
72		—	—										
73		9g	—										
74		9a	—	0		0							
75		9d	—		0								0
76		9g	3m	0	0	0				0	0	0	0
77		9a	3m	0	0	0	0	0	0	0	0	0	
78		9d	3m	0	0	0	0	0	0	0	0	0	0
79	F (Cold SBR)	6d	3k	0	0	0	0	0	0	0	0	0	0
80	G (Cold SBR)	1.4c 3.3d 2. f	3m	0	0	0			0	0	0	0	0
81	H (Neoprene)	4d 4f	—	0	0	0	0		0	0	0	0	0
82	I (Neoprene)	4d	—	0	0	0	0	0	0	0	0	0	0
83	J (Neoprene)	4d 4f	—	0	0	0	0	0	0	0	0	0	0

Sample No.	Base Compound	Protection: Wax (Phr)	Protection: Other (Phr)	O_3 Chambers (1 Mo.): 110° F. 25 pphm		120° F. 25 pphm		100° F. 50 pphm	Outdoors: L.A. 18 Mos.		Outdoors: M.H. 18 Mos.		Yuma 15 Mos.
				1	2	1	2	2	1	2	1	2	1
84	H	—	—					0			0		
85	(Neoprene)	2f	—	0	0	0	0	0	0	0	0	0	0
		6g											
86	↓	6a		0	0	0	0	0	0	0	0	0	0
87		6d		0	0	0	0	0	0	0	0	0	0
88		3f								0	0	0	
	K (Neoprene)												
89	L (Neoprene)	4d		0	0	0	0	0	0	0	0	0	0
		3f											
90	M (Natural Rubber)	4.5c	—										
91	N (Natural Rubber)	6c	3k										
92	P (Nitrile)	4d	3k										
93	Q (Butyl)	2f	—										

APPENDIX II

Part II Ozone Chamber and Outdoor Data

0 indicates that specimens had no cracks visible to the naked eye.

See Table 1 for base compound key.

Sample No.	Base Compound	Protection: Wax (Phr)	Protection: Other (Phr)	O_3 Chambers (1 Mo.): 110° F. 25 pphm	120° F. 25 pphm	100° F. 50 pphm	Outdoors at M.H. One Year
1	N	6a	3k				
2	(Natural	9a	3k		0		
3	Rubber)	6a	—				
4	↓	9a	—				
5		6d	3k				
6		9d	3k				
7		6d	—				
8		9d	—				
9		6e	3k				
10		9e	3k	0	0		
11		6e	—				
12		9e	—				
13		—	2r				
14		6c	—				
15		6c	1r				
16		6c	2r				
17	↓	6c	3r				
18	P	6a	3k				
19	(Nitrile)	9a	3k				
20		6a	—				
21		9a	—				
22		6c	3k				
23		9c	3k				
24		6c	—				
25		9c	—				
26		6d	3k				
27		9d	3k				
28		6d	—				
29	↓	9d	—				
30	A	3e	—				
31	(Hot	6e	—	0			
32	SBR)	8e	—	0			
33		9a	—				
34		9c	—	0			
35		9d	—				
36		—	5k				
37		6c	—				
38		6c	1r				
39		6c	2r				
40		6c	3r	0	0	0	
41		—	5m				
42		—	3r				0

Sample No.	Base Compound	Protection: Wax (Phr)	Protection: Other (Phr)	O_3 Chambers (1 Mo.): 110° F. 25 pphm	120° F. 25 pphm	100° F. 50 pphm	Outdoors at M.H. One Year
43		6a	3k	0	0	0	0
44		6a	2m	0	0	0	
45		6a	5p	0	0		0
46		6a	5q	0	0	0	
47		6d	2r				0
48		3d	3k				0
49		6d	3k				0
50		3d	2m	0			0
51		6d	2m	0	0	0	0
52		3d	5p				0
53		6d	5p	0	0		0
54		3d	5q				0
55		6d	5q	0	0		0
56		3d	3m	0	0		0
57	↓	6d	3m		0		0
58	B	9a	—				
59	Cold	9d	—				
60	(Oil-	—	3r				0
61	Extended	6a	3k	0	0	0	
62	SBR)	6a	5p	0	0	0	
63		6a	3q	0	0	0	
64		6a	5q	0	0	0	
65		6d	3k				0
66		6d	3m	0	0		
67		6d	3p		0		0
68		6d	3q				0
69		3a	2t	0	0	0	
70		3a	4t	0		0	
71		3a	6t			0	
72		3a	8t		0	0	
73		2.4h	0.6r				
74		4.8h	1.2r	0	0	0	0
75		7.2h	1.8r	0	0	0	0
76		2.7h	0.3r			0	
77		5.4h	0.6r	0	0	0	
78	↓	8.1h	0.9r	0	0	0	0
79	C	6d	—				
80	(Hot	9d	—				
81	SBR)	6a	—				
82		9a	—				
83		6c	—				
84		9c	—				
85		6e	—				
86		9e	—				
87		3d	3k				
88		6d	3k				
89		3d	2m				
90		6d	2m				
91		3d	3p				
92		6d	3p				

Sample No.	Base Compound	Protection Wax (Phr)	Protection Other (Phr)	O_3 Chambers (1 Mo.) 110° F. 25 pphm	120° F. 25 pphm	100° F. 50 pphm	Outdoors at M.H. One Year
93		3d	3q				
94		6d	3q				
95		3a	3k				
96		6a	3k	0	0	0	
97		3a	2m				
98		6a	2m	0	0	0	
99		3a	3p				
100		6a	3p	0	0		
101		3a	3q				
102		6a	3q	0	0	0	
103	D	—	3r	0	0		0
104	(Cold	3d	2r	0			0
105	Oil-	9c	—				
106	Extended	6e	—				
107	SBR)	9a	3k	0	0	0	0
108		9a	3p	0	0	0	0
109		9a	3q	0	0	0	
110		6a	3m	0	0	0	
111		6a	3k	0	0	0	
112		6a	3p	0	0	0	
113		6a	3q	0	0	0	0
114		9e	—	0	0		
115		2.4h	0.6r				
116		4.8h	1.2r	0			0
117		7.2h	1.8r	0	0	0	0
118		2.7h	0.3r				
119		5.4h	0.6r	0			
120		8.1h	0.9r	0	0	0	0
121	R	3f	—				
122	(Butyl)	6f	—				
123		3a	—				
124		6a	—				
125		3d	—				
126		6d	—				
127		—	1r				
128		—	2r				
129		—	3r			0	
130		2.4h	0.6r				
131		4.8h	1.2r	0	0	0	0
132		3h	—				
133		6h	—	0		0	
134		—	10s				
135		—	20s				
136	S	3f	—				
137	(Butyl)	6f	—				
138		3a	—				
139		6a	—				
140		3d	—				
141		6d	—				
142		—	1r				
143		—	2r				
144		—	3r				
145		2.4h	0.6r				
146		4.8h	1.2r	0	0	0	0
147		3h	—				
148		6h	—				
149		—	10s				
150		—	20s				
151	T	3f	—				
152	(Butyl)	6f	—			0	
153		3a	—	0		0	
154		6a	—	0	0	0	
155		3d	—				0
156		6d	—		0		0
157		—	1r				
158		—	2r		0		
159		—	3r	0	0	0	0
160		2.4h	0.6r			0	
161		4.8h	1.2r	0	0	0	0
162		3h	—			0	0
163		6h	—	0	0	0	0
164		—	10s				
165		—	20s				
166	U	3f	—				
167	(Butyl)	6f	—				
168		3a	—	0		0	
169		6a	—	0		0	
170		3d	—				0
171		6d	—	0			0
172		—	1r				
173		—	2r				
174		—	3r	0	0		
175		2.4h	0.6r			0	0
176		4.8h	1.2r	0	0	0	0
177		3h	—			0	0
178		6h	—	0	0	0	0
179		—	10s				
180		—	20s				
181	P	6c	—				
182	(Nitrile	6c	1r				
183		6c	2r				
184		6c	3r	0	0	0	

Note: All compounds cured 20 minutes at 307° F.

Bibliography

(1) W. F. Tuley, *Rubber Chem. Tech.*, 12, 836 (1939).
(2) J. T. Beaudry, *Rubber Age (N. Y.)*, 69, 429 (1951).
(3) *J. Phys. Chem.*, 33, 226 (1929).
(4) *Rubber Chem. Tech.*, 18, 504 (1945).
(5) *Ibid.*, 28, 230 (1955).
(6) *Ibid.*, 27, 175 (1954).
(7) J. Crabtree, A. R. Kemp, *Ibid.*, 19, 712 (1946).
(8) "Concentration of Oxidizing Substances in the Atmosphere of a Number of American Cities." Kettering Laboratory, University of Cincinnati, Cincinnati, O. (Sept., 1954).
(9) Rubber World, 133, 803 (1956).
(10) *Rubber Chem. Tech.*, 25, 945 (1952).
(11) F. E. Littman, R. W. Benoliel, *Anal. Chem.*, 25, 1480 (1953).
(12) J. Crabtree, A. R. Kemp, *Rubber Chem. Tech.*, 20, 808 (1947).
(13) "An Aerometric Survey of the Los Angeles Basin." Air Pollution Foundation, 704 S. Spring St., Los Angeles, Calif. (July 1, 1955).
(14) "The Smog Problem in Los Angeles County." Western Oil & Gas Assn., 510 W. Sixth St., Los Angeles, Calif. (Jan., 1954).
(15) *Chem. Eng. News*, Oct. 3, 1955, p. 4143.
(16) *Rubber Age (N. Y.)*, 66, 659 (1950).
(17) ASTM Designation: D1149-55T. "ASTM Standards on Rubber Products," p. 600. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. (May, 1956).
(18) ASTM Designation: D470-54T. "ASTM Standards on Rubber Products," p. 247.
(19) ASTM Designation: D1352-54T. "ASTM Standards on Rubber Products," p. 671.
(20) ASTM Designation: D518-44, Method B. "ASTM Standards on Rubber Products," p. 277.

Seaborg: More Basic Research

A plea for more basic research was voiced by Glenn Seaborg, Nobel Laureate and professor of chemistry at the University of California (Berkeley), upon receiving the fifty-first impression of the Perkin Medal of the American Section, Society of Chemical Industry, in January.

Mr. Seaborg told the gathering of scientists and industrial executives at the Waldorf-Astoria Hotel, New York, N. Y., that if the nation should double its current expenditures for basic research "the return on overall research spending would be way out of proportion to the small relative initial cost." Although he felt that the universities would continue to remain the centers of basic research, he urged industry not to overlook its responsibilities in supporting this work.

The Determination of Oil and Stabilizer in Oil-Masterbatched Polymers[1]

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A procedure is outlined for the simultaneous determination by ultra-violet spectrophotometry of oil and stabilizer in oil-masterbatched styrene-butadiene rubber.

The results for the oil are satisfactory within 1% of the actual oil content; the stabilizer results, when the stabilizer is a diphenylamine-acetone reaction product, within 0.1%.

When the stabilizer is phenyl-beta-naphthylamine, the results are less satisfactory; however, if only a rough determination is needed, the procedure may still be useful.

BECAUSE of the increasing use of oil-extended synthetic rubber it has become desirable to develop a method for determining the stabilizer content in the presence of processing oils, as well as the amount of the oils themselves.[4] This presents difficulties, because the ultra-violet absorption spectra of the oils overlap the wave-length range in which the absorption peaks of several of the commonly used stabilizers occur.

Spectrophotometric techniques combining differential and multi-component analysis methods appeared to be adaptable to determinations of oil and stabilizer content in rubber. At the request[5] of the former Office of Synthetic Rubber, Federal Facilities Corp., a number of oil masterbatches of known composition were prepared and analyzed for oil and stabilizer content in accordance with such a method.

Analytical Principle

When two components whose ultra-violet absorption spectra overlap are present in the same solution, it is necessary to make use of a technique which compensates for this factor when determining the content of either component. It is also highly desirable to employ a procedure which yields the greatest possible precision of spectrophotometry. In recent years a great increase in precision has been achieved by differential analysis, and this technique has also been applied to multi-component analysis.

Differential analysis, or precision spectrophotometry,[6] consists in measuring absorbency against a standard rather than against a solvent. When this is done, the measured absorbency is determined by the concentration difference between the sample and the reference standard, as can be shown by the absorption laws. It has also been shown that the error in measurement of total concentration is dependent on the absorbency of the reference standard, and that the minimum relative error is obtained when the absorbencies of sample and reference are almost equal.

The principles of differential analysis have also been applied to multi-component analysis.[7] At a given wave length the absorbency of a solution containing more than one component will be equal to the sum of the absorbencies of the components at that wave length, if the absorption laws hold. As the absorbency is equal to the product of the absorbency index, the concentration, and the length of the light path, the absorbencies of a two-component solution at two wave lengths, λ and λ', can be expressed as:

$$A = K_x b c_x + K_y b c_y$$
$$A' = K'_x b c_x + K'_y b c_y$$

where: A and A′ = absorbencies at wave lengths λ and λ'
K and K′ = absorbency indices at wave lengths λ and λ'
b = length of light path
c = concentration, gm/liter
$_x$ and $_y$ = components

For the Beckman[8] Model DU spectrophotometer, b = 1. These equations may then be solved simultaneously for c_x and c_y.

$$c_x = \frac{A}{K_x - \frac{K'_x K_y}{K'_y}} + \frac{A'}{K'_x - \frac{K_x K'_y}{K_y}}$$

$$c_y = \frac{A}{K_y - \frac{K'_y K_x}{K'_x}} + \frac{A'}{K'_y - \frac{K_y K'_x}{K_x}}$$

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[2]Present address, Olin Mathieson Chemical Corp., Niagara Falls, N. Y.
[3]Present address, Goodyear Atomic Energy Corp., Portsmouth, O.
[4]RUBBER WORLD, Dec., 1955, p. 383; Feb., 1956, p. 659.
[5]T. H. Swan to W. K. Taft, private communication, Apr. 30, 1954.
[6]C. F. Hiskey, *Anal. Chem.*, 21, 1440 (1949).
[7]C. F. Hiskey, D. Firestone, *Ibid.*, 24, 342 (1952).
[8]Beckman Instruments, Inc., South Pasadena, Calif.

TABLE 1. ULTRA-VIOLET ABSORBENCY DATA

Sample No.	Trial No.	A_1	A_2	A_3	A_4	Δc_x	Δc_y	K_x^{275}	K_x^{288}	K_y^{275}	K_y^{288}
A&B	1	0.037	0.045	0.068	0.051	0.0006	0.0036	61.667	75.000	18.889	14.167
		0.037	0.049	0.069	0.051	"	"	61.667	81.667	19.167	14.167
A&B	2	0.034	0.047	0.069	0.052	"	"	56.667	78.333	19.167	14.444
		0.033	0.046	0.067	0.051	"	"	55.000	78.667	18.611	14.167
A&B	3	0.036	0.048	0.066	0.052	"	"	60.000	80.000	18.333	14.444
		0.036	0.047	0.068	0.051	"	"	60.000	78.333	18.889	14.167
A&B	4	0.035	0.049	0.068	0.050	"	"	58.333	81.667	18.889	13.889
		0.036	0.046	0.070	0.052	"	"	60.000	76.667	19.444	14.444
A&B	5	0.032	0.047	0.062	0.047	"	"	53.333	78.333	17.222	13.056
		0.036	0.046	0.070	0.052	"	"	60.000	76.667	19.444	14.444

TABLE 2. ULTRA-VIOLET ABSORBENCY DATA

Sample No.	Trial No.	A^{275}	A^{288}	Δc_x	Δc_y	c_x^r	c_y^r	c_x	c_y	W
A	1	0.081	0.060	-0.000009	∕0.004288	0.001720	0.04503	0.001711	0.049318	0.1802
		0.074	0.057	∕0.000059	∕0.003699	"	"	0.001779	0.048729	0.1799
B		0.065	0.050	∕0.000049	∕0.003256	"	"	0.001769	0.048286	0.1798
		0.059	0.047	∕0.000095	∕0.002794	"	"	0.001815	0.047824	0.1800
A	2	0.078	0.058	∕0.000031	∕0.004220	0.001716	0.04503	0.001747	0.049250	0.1805
		0.076	0.060	∕0.000069	∕0.003819	"	"	0.001785	0.048849	0.1797
B		0.072	0.057	∕0.000070	∕0.003605	"	"	0.001786	0.048635	0.1799
		0.065	0.052	∕0.000079	∕0.003209	"	"	0.001795	0.048239	0.1800
A	3	0.075	0.057	-0.000020	∕0.004094	0.001724	0.04505	0.001704	0.049144	0.1804
		0.075	0.060	∕0.000071	∕0.003801	"	"	0.001795	0.048851	0.1801
B		0.071	0.055	∕0.000012	∕0.003774	"	"	0.001736	0.048824	0.1798
		0.072	0.055	-0.000011	∕0.003903	"	"	0.001713	0.048953	0.1799
A	4	0.076	0.064	∕0.000221	∕0.003284	0.001721	0.04500	0.001942	0.048284	0.1799
		0.080	0.062	∕0.000081	∕0.003924	"	"	0.001802	0.048924	0.1803
B		0.075	0.056	∕0.000016	∕0.003864	"	"	0.001737	0.048864	0.1800
		0.068	0.052	∕0.000049	∕0.003396	"	"	0.001770	0.048396	0.1798
A	5	0.068	0.052	∕0.000029	∕0.003622	0.001721	0.04500	0.001750	0.048622	0.1800
		0.080	0.060	0	∕0.004664	"	"	0.001721	0.049664	0.1800
B		0.066	0.050	∕0.000015	∕0.003556	"	"	0.001736	0.048556	0.1800
		0.069	0.053	∕0.000035	∕0.003653	"	"	0.001756	0.048653	0.1800

TABLE 3. PREPARATION OF SOLUTIONS

Sample No.	1B-1	1P-2	1P-3	1B-4	1P-5
Solution #1					
Polymer	1B	1P	1P	1B	1P
Weight, gm/500 ml.	0.1560	0.1734	0.2600	0.2600	0.2600
Solution #2					
Oil	Dutrex 20	Califlux TT	Philrich 5	SPX-97	Sundex-53
Weight, gm/250 ml.	0.2700	0.3000	0.4500	0.4500	0.4500
Solution #2A					
Aliquot Sol. #2, ml.	20	20	20	20	20
Volume, ml.	200	200	200	200	200
Solution #3					
Stabilizer	BLE	PBNA	PBNA	BLE	PBNA
Weight, gm/500 ml.	0.1500	0.1500	0.1500	0.1500	0.1500
Solution #3A					
Aliquot Sol. #3, ml.	10	10	10	10	10
Volume, ml.	100	100	100	100	100
Solution #4					
Aliquot Sol. #1, ml.	25	25	25	25	25
Aliquot Sol. #2A, ml.	25	25	25	25	25
Volume, ml.	100	100	100	100	100
Solution #5A					
Aliquot Sol. #1, ml.	50	50	25	50	50
Aliquot Sol. #2A, ml.	25	25	25	25	25
Aliquot Sol. #3A, ml.	2	2	2	2	2
Volume, ml.	100	100	100	100	100
Solution #5B					
Aliquot Sol. #1, ml.	50	50	25	50	50
Aliquot Sol. #2A, ml.	25	25	25	25	25
Volume, ml.	100	100	100	100	100
Solution #6A					
Aliquot Sol. #1, ml.	50	50	50	50	50
Aliquot Sol. #2A, ml.	12	12	12	12	12
Volume, ml.	100	100	100	100	100
Solution #6B					
Aliquot Sol. #1, ml.	50	50	50	50	50
Aliquot Sol. #2A, ml.	10	10	10	10	10
Volume, ml.	100	100	100	100	100
Sample solutions					
Weight, gm/100 ml.	0.1050	0.1200	0.1800	0.1800	0.1800
Aliquot Diluted, ml.	10	10	10	10	10
Volume Dilution, ml.	100	100	100	100	100

Sample No.	2P-1	2B-2	2B-3	2P-4	2P-5
Solution #1					
Polymer	2P	2B	2B	2P	2P
Weight, gm/500 ml.	0.1560	0.1734	0.2600	0.2600	0.2600
Solution #2					
Oil	Dutrex 20	Califlux TT	Philrich 5	SPX-97	Sundex-53
Weight, gm/250 ml.	0.2700	0.3000	0.4500	0.4500	0.4500
Solution #2A					
Aliquot Sol. #2, ml.	20	20	20	20	20
Volume, ml.	200	200	200	200	200
Solution #3					
Stabilizer	PBNA	BLE	BLE	PBNA	PBNA
Weight, gm/500 ml.	0.1500	0.1500	0.1500	0.1500	0.1500
Solution #3A					
Aliquot Sol. #3, ml.	10	10	10	10	10
Volume, ml.	100	100	100	100	100
Solution #4					
Aliquot Sol. #1, ml.	25	25	25	25	25
Aliquot Sol. #2A, ml.	25	25	25	25	25
Volume, ml.	100	100	100	100	100
Solution #5A					
Aliquot Sol. #1, ml.	50	50	25	50	50
Aliquot Sol. #2A, ml.	25	25	25	25	25
Aliquot Sol. #3A, ml.	2	2	2	2	2
Volume, ml.	100	100	100	100	100
Solution #5B					
Aliquot Sol. #1, ml.	50	50	25	50	50
Aliquot Sol. #2A, ml.	25	25	25	25	25
Volume, ml.	100	100	100	100	100
Solution #6A					
Aliquot Sol. #1, ml.	50	50	50	50	50
Aliquot Sol. #2A, ml.	12	12	12	12	12
Volume, ml.	100	100	100	100	100
Solution #6B					
Aliquot Sol. #1, ml.	50	50	50	50	50
Aliquot Sol. #2A, ml.	10	10	10	10	10
Volume, ml.	100	100	100	100	100
Sample Solutions					
Weight, gm/100 ml.	0.1050	0.1200	0.1800	0.1800	0.1800
Aliquot Diluted, ml.	10	10	10	10	10
Volume Dilution, ml.	100	100	100	100	100

The absorbency indices of the components at both wave lengths can readily be determined, as can the absorbencies of the solution; the concentrations are the only unknowns.

For multi-component analyses of oil-polymer masterbatches, the method of Beroza[9] seemed to be most applicable. The absorbency of the sample solution is measured against a reference standard containing the same components in approximately the same concentrations as the unknown. When this method is used, slight deviations from the absorption laws can be tolerated.

Experimental Procedure

As a preliminary step to determine whether the procedure would be applicable to this type of system, duplicate masterbatches of known composition were prepared and analyzed. A 150-gram portion of an aromatic processing oil[10] was milled into 400-gram GR-S-X723 (containing 1.324% BLE-25[11]), resulting in masterbatches of the following composition:

Sundex 53	27.3%
BLE-25	0.963%
Polymer	71.8%

Portions of oil and polymer, as well as a sample of standard BLE-25, were reserved for preparation of the standard solutions.

The solvent used throughout was a mixture of 85% methylcyclohexane/15% absolute ethanol, having a transmittancy of greater than 90% at the wave lengths used. All solutions were prepared in volumetric flasks and mixed thoroughly.

Solution #1 —Standard Polymer Solution
0.2600- ±0.0010-gm. GR-S-X723 was dissolved in solvent, and the solution made up to 500 ml.

Solution #2 —Standard Oil Solution
0.4500- ±0.0010-gm. Sundex-53 was dissolved in solvent, and the solution was then diluted to 250 ml.

Solution #2A—
Twenty ml. of Solution #2 were pipetted into a 200-ml. volumetric flask and diluted to volume.

Solution #3 —Standard Stabilizer Solution
0.150- ±0.0010-gm. BLE-25 was dissolved in solvent, and the solution was then diluted to 500 ml.

Solution #3A—
Ten ml. of Solution #3 were pipetted into a 100-ml. volumetric flask and diluted to volume.

From these standard solutions, the sample reference solution, the absorbency index solutions, and the absorbency index references were prepared.

Solution #4 —Sample Reference Solution
Twenty-five ml. of Solution #1 and 25 ml. of Solution #2A were pipetted into a 100-ml. volumetric flask, diluted to volume, and mixed thoroughly.

Solution #5A—Stabilizer Absorbency Index Solution
Fifty ml. of Solution #1, 25 ml. of Solution #2A, and 2 ml. of Solution #3A were pipetted into a 100-ml. volumetric flask and diluted to volume.

Solution #5B—Stabilizer Absorbency Index Reference
Fifty ml. of Solution #1 and 25 ml. of Solution #2A were pipetted into a 100-ml. volumetric flask and diluted to volume.

Solution #6A—Oil Absorbency Index Solution
Fifty ml. of Solution #1 and 7 ml. of Solution #2A were pipetted into a 100-ml. volumetric flask and diluted to volume.

Solution #6B—Oil Absorbency Index Reference
Fifty ml. of Solution #1 and 5 ml. of Solution #2A were pipetted into a 100-ml. volumetric flask and diluted to volume.

Sample solutions were prepared by dissolving 0.1800- ±0.0010-gram of the prepared oil-polymer masterbatches in approximately 50 milliliters of solvent in a 100-milliliter volumetric flask. The solution was then made up to volume and mixed thoroughly. A 10-milliliter aliquot of this solution was pipetted into a 100-milliliter volumetric flask, diluted to volume, and mixed thoroughly.

Determinations were made on the duplicate masterbatches on each of five days. Duplicate solutions of both samples, as well as solutions #5A and #6A were prepared daily. The absorbencies of the solutions were determined at 275 and 288 mμ; Solution #4 was the reference for the sample solutions; #5B for the stabilizer absorbency indices; and #6B for the oil absorbency indices.

The stabilizer absorbency indices were calculated from the absorbencies of Solution #5A.

$$K_x^{275} = \frac{A_1}{\Delta c_x} \qquad K_x^{288} = \frac{A_2}{\Delta c_x}$$

where: K_x^{275} = absorbency index of BLE-25 at 275 mμ wave length
K_x^{288} = absorbency index of BLE-25 at 288 mμ wave length
A_1 = absorbency of Solution #5A at 275 mμ wave length
A_2 = absorbency of Solution #5A at 288 mμ wave length
Δc_x = difference in concentration of BLE-25 between solutions #5A and #5B, expressed as gm/liter.

The absorbency indices of the oil were calculated from the absorbencies of Solution #6A.

$$K_y^{275} = \frac{A_1}{\Delta c_y} \qquad K_y^{288} = \frac{A_2}{\Delta c_y}$$

where: K_y^{275} = absorbency index of Sundex 53 at 275 mμ wave length

[9] M. Beroza, *Anal. Chem.*, 25, 112 (1953).
[10] Sundex 53, Sun Oil Co. trade mark.
[11] Naugatuck Chemical Division, United States Rubber Co., trade mark. Diphenyl-amine-acetone reaction product.

TABLE 4. RESULTS OF ANALYSES

Sample No.	Trial No.	Stabilizer %	D_s[a]	Oil %	D_o[b]
A (0.963% BLE, 27.3% Sundex-53)	1	0.950	-0.013	27.4	+0.1
		0.989	+0.026	27.1	-0.2
B		0.984	+0.021	26.9	-0.4
		1.008	+0.045	26.6	-0.7
A	2	0.968	+0.005	27.3	0
		0.993	+0.030	27.2	-0.1
B		0.993	+0.030	27.0	-0.3
		0.997	+0.034	26.8	-0.5
A	3	0.945	-0.018	27.2	-0.1
		0.997	+0.034	27.1	-0.2
B		0.966	+0.003	27.2	-0.1
		0.952	-0.011	27.2	-0.1
A	4	1.079	+0.106	26.8	-0.5
		0.999	+0.036	27.1	-0.2
B		0.965	+0.002	27.1	-0.2
		0.984	+0.021	26.9	-0.4
A	5	0.972	+0.009	27.0	-0.3
		0.956	-0.007	27.6	+0.3
B		0.964	+0.001	27.0	-0.3
		0.976	+0.013	27.0	-0.3
1P-5	1	0.647	-0.178	27.4	+0.4
0.825% PBNA		0.593	-0.232	27.1	+0.1
27.0% Sundex-53	2	0.532	-0.293	27.6	+0.6
		0.532	-0.293	27.6	+0.6
	3	0.722	-0.103	26.7	-0.3
		0.702	-0.123	26.8	-0.2
	4	0.714	-0.111	26.7	-0.3
		0.741	-0.084	26.7	-0.3
	5	0.768	-0.057	26.7	-0.3
		0.914	+0.089	26.2	-0.8
2P-1	1	0.658	-0.203	27.2	+0.2
0.861% PBNA		0.564	-0.297	27.4	+0.4
27.0% Dutrex 20	2	0.598	-0.263	27.3	+0.3
		0.576	-0.285	27.4	+0.4
	3	0.651	-0.210	27.3	+0.3
		0.651	-0.210	27.3	+0.3
	4	0.359	-0.502	27.7	+0.7
		0.574	-0.287	27.5	+0.5
	5	0.684	-0.177	27.1	+0.1
		0.774	-0.087	26.8	-0.2
2P-4	1	0.448	-0.413	28.5	+1.5
0.861% PBNA		0.763	-0.098	27.3	+0.3
27.0% Shell SPX-97	2	1.081	+0.220	26.2	-0.8
		0.716	-0.145	27.5	+0.5
	3	0.786	-0.075	27.2	+0.2
		0.739	-0.122	27.3	+0.3
	4	0.736	-0.125	27.2	+0.2
		0.662	-0.239	27.4	+0.4
	5	0.485	-0.376	27.9	+0.9
		0.512	-0.349	27.9	+0.9
2P-5	1	0.785	-0.076	27.3	+0.3
0.861% PBNA		0.707	-0.154	27.7	+0.7
27.0% Sundex-53	2	0.646	-0.215	27.6	+0.6
		0.600	-0.261	27.8	+0.8
	3	0.650	-0.211	27.7	+0.7
		0.700	-0.161	27.5	+0.5
	4	0.764	-0.097	27.2	+0.2
		0.779	-0.082	27.2	+0.2
	5	0.827	-0.034	26.9	-0.1
		0.850	-0.011	26.7	-0.3
1B-1	1	1.021	+0.045	26.3	-0.7
0.976% BLE		1.021	+0.045	26.4	-0.6
27.0% Dutrex 20	2	1.012	+0.036	26.5	-0.5
		0.977	+0.001	26.5	-0.5
	3	1.024	+0.048	26.5	-0.5
		1.060	+0.084	26.4	-0.6
	4	1.096	+0.120	26.2	-0.8
		1.045	+0.069	26.4	-0.6
	5	0.989	+0.003	26.7	-0.3
		0.994	+0.018	26.7	-0.3
1B-4	1	0.985	+0.009	27.0	0
0.976% BLE		0.994	+0.018	27.0	0
27.0% Shell SPX-97	2	1.019	+0.043	26.9	-0.1
		1.014	+0.038	26.9	-0.1
	3	0.962	-0.014	27.0	0
		0.969	-0.007	27.1	+0.1
	4	0.979	+0.003	26.6	-0.4
		0.959	-0.017	26.9	-0.1
	5	0.974	-0.002	26.7	-0.3
		1.001	+0.025	26.7	-0.3

[a] D_s = difference between determined stabilizer value and known stabilizer value. [b] D_o = difference between determined oil value and known oil value.

TABLE 4 (Continued)

Sample No.	Trial No.	Stabilizer %	D_s[a]	Oil %	D_o[b]
2B-2	1	0.942	±0.047	26.4	-0.6
0.895% BLE		0.973	±0.078	26.4	-0.6
27.0% Califlux TT	2	0.951	±0.056	26.4	-0.6
		0.951	±0.056	26.5	-0.5
	3	0.986	±0.091	26.5	-0.5
		1.014	±0.119	26.5	-0.5
	4	0.913	±0.018	26.4	-0.6
		0.969	±0.074	26.4	-0.6
	5	0.978	±0.083	26.7	-0.3
		0.978	±0.083	26.7	-0.3
2B-3	1	0.936	±0.041	27.2	±0.2
0.895% BLE		0.939	±0.044	27.2	±0.2
27.0% Philrich 5	2	0.909	±0.014	27.0	0
		0.933	±0.038	26.9	-0.1
	3	0.917	±0.022	26.9	-0.1
		0.912	±0.017	26.9	-0.1
	4	0.916	±0.021	26.8	-0.2
		0.923	±0.028	26.8	-0.2
	5	0.962	±0.067	26.6	-0.4
		0.931	±0.036	27.0	0
1P-2	1	0.978	±0.153	26.5	-0.5
0.825% PBNA		0.883	±0.058	26.7	-0.3
27.0% Califlux TT	2	0.726	-0.099	26.9	-0.1
		0.806	-0.019	26.6	-0.4
	3	0.791	-0.034	26.5	-0.5
		0.748	-0.077	26.7	-0.3
	4	0.697	-0.128	27.1	±0.1
		0.621	-0.204	27.2	±0.2
	5	0.775	-0.050	26.6	-0.4
		0.729	-0.096	26.8	-0.2
1P-3	1	0.632	-0.193	27.3	±0.3
0.825% PBNA		0.904	±0.079	26.4	-0.6
27.0% Philrich 5	2	0.779	-0.046	26.5	-0.5
		0.848	±0.023	26.5	-0.5
	3	0.742	-0.083	27.0	0
		0.654	-0.171	27.2	±0.2
	4	0.728	-0.097	26.9	-0.1
		0.756	-0.069	26.8	-0.2
	5	0.722	-0.103	27.0	0
		0.791	-0.034	26.8	-0.2

K_y^{288} = absorbency index of Sundex 53 at 288 mμ wave length

A_3 = absorbency of Solution #6A at 275 mμ wave length

A_4 = absorbency of Solution #6A at 288 mμ wave length

Δc_y = difference in concentration of Sundex 53 between solutions #6A and #6B, expressed as gm/liter.

The difference in concentration between the sample solutions and the reference solution, Solution #4, were then calculated from the following formulae. The absorbency index values used were averages of the duplicates determined on the same day as the sample being calculated.

$$\Delta c_x = \frac{A^{275}}{K_x^{275} - \frac{K_x^{288} K_y^{275}}{K_y^{288}}} + \frac{A^{288}}{K_x^{288} - \frac{K_x^{275} K_y^{288}}{K_y^{275}}}$$

$$\Delta c_y = \frac{A^{275}}{K_y^{275} - \frac{K_y^{288} K_x^{275}}{K_x^{288}}} + \frac{A^{288}}{K_y^{288} - \frac{K_y^{275} K_x^{288}}{K_x^{275}}}$$

where: A^{275} = absorbency of sample solution at 275 mμ wave length

A^{288} = absorbency of sample solution at 288 mμ wave length

K_x^{275} = average absorbency index of stabilizer at 275 mμ wave length

K_x^{288} = average absorbency index of stabilizer at 288 mμ wave length

K_y^{275} = average absorbency index of oil at 275 mμ wave length

K_y^{288} = average absorbency index of oil at 288mμ wave length

Δc_x = difference in concentration of stabilizer between samples and reference solutions, expressed as gm/liter

Δc_y = difference in concentration of oil between sample and reference solutions, expressed as gm/liter.

The concentrations of BLE-25 and Sundex 53 in the sample solution were then calculated.

$$c_s = c'_s + \Delta c_s$$
$$c_o = c'_o + \Delta c_o$$

where: c'_s = concentration of stabilizer in the reference solution, gm/liter

c'_o = concentration of oil in the reference solution, gm/liter

c_s = concentration of stabilizer in the sample solution, gm/liter

c_o = concentration of oil in the sample solution, gm/liter.

The percentage concentration can then be calculated, as below:

$$\% \text{ BLE-25} = \frac{c_s \times 100}{W}$$

$$\% \text{ Sundex 53} = \frac{c_o \times 100}{W}$$

where: W = concentration of sample in solution, gm/liter.

These data are shown in Tables 1 and 2, and the results are summarized at the beginning of Table 4. Because the results of this preliminary determination were satisfactory the investigation was extended to include several other combinations of oils, stabilizers, and polymers.

Additional Analyses

Two 20-gallon batches of latex were prepared, one batch with mixed soap emulsifier as in GR-S 1710, the other with rosin soap as in GR-S 1709. The resulting latices were divided into two parts; phenyl-beta-naphthylamine (PBNA) was added to one portion, and BLE to the other. The polymers were then coagulated and dried. The portion of the polymer containing PBNA from the latex prepared with the mixed soap emulsifier was coded 1P, that containing BLE was coded 1B; from the latex prepared with rosin soap emulsifier, the portion containing PBNA was coded 2P, and that containing BLE was coded 2B.

Ten analyses for stabilizer content[12] were made on each of the four samples, and the value for stabilizer content used in computing the composition of the masterbatches prepared was the average of the 10, as shown below:

	1P	1B	2P	2B
Average stabilizer content, %	1.131	1.338	1.180	1.227
Standard deviation	0.013	0.012	0.008	0.019
Maximum difference, 10 analyses	0.038	0.031	0.022	0.054

Oil masterbatches were prepared from these polymers by milling 150 grams of each of five oils into 405 grams of polymer. The composition of the masterbatches is shown:

Sample No.	Polymer	Oil—%	Stabilizer—%
1B-1	1B	Dutrex 20[13]—27	BLE—0.976
1P-2	1P	Califlux TT[14]—27	PBNA—0.825
1P-3	1P	Philrich 5[15]—27	PBNA—0.825
1B-4	1B	Shell SPX-97[16]—27	BLE—0.976
1P-5	1P	Sundex-53—27	PBNA—0.825
2P-1	2P	Dutrex 20—27	PBNA—0.861
2B-2	2B	Califlux TT—27	BLE—0.895
2B-3	2B	Philrich 5—27	BLE—0.895
2P-4	2P	Shell SPX-97—27	PBNA—0.861
2P-5	2P	Sundex-53—27	PBNA—0.861

Solutions for absorbency measurements were prepared in the same manner as for the determinations previously discussed; however, some changes in concentration were necessary because of the higher absorbency indices of some of the oils. Sample weights and aliquots are shown in Table 3.

Determinations of absorbencies and calculation of percentage composition were carried out as they had been for the preliminary samples.

Results and Discussion

In Table 4 are shown the determined percentages of stabilizer and oil, as well as the difference between each determined value and the known value.

Considering the data showing the determined oil content, the procedure appears to be satisfactory within 1%. Of the 120 single determinations, 119 are within 1% of the known oil content; if the duplicate pairs are averaged, all of the 60 averages are within 1%. One-hundred-thirteen of the single runs, and 58 of the averages are within 0.7% of the known value. In general, the results of the oil determination tend to be either predominantly low or predominantly high for any one sample.

As a test for BLE content in the presence of oil, the procedure also seems to be satisfactory. Fifty-seven of the 60 single runs are within 0.1% of the known value; 29 of the 30 averages of duplicate pairs are within 0.1%. The BLE results tend to be high.

The PBNA results are less acceptable. Only 25 of the 60 single determinations, or 13 of the 30 averages, are within 0.1% of the known value. The scatter is also much greater. If it were desired, however, to determine stabilizer only within a wide range, for example, that stated in Specifications for Government Synthetic Rubbers, the procedure might still be usable. A stabilizer content of 1% to 1.75% based on oil-free polymer is equivalent to 0.73 to 1.27%, based on oil-polymer masterbatch containing 37.5 phr. of oil, or an allowable range of ±0.27%. Fifty-two of the 60 single runs, or 26 of the 30 averages of duplicate pairs, fall within this range. The PBNA results are almost invariably low.

It appears that more difficulty is encountered when PBNA is determined in the presence of Dutrex 20 and SPX-97 than the other three oils. Possibly some changes could be made in the procedure, which would make it more suitable for PBNA determinations. Further experience is necessary in order to determine whether the

(*Continued on page 722*)

[12] Specifications for Government Synthetic Rubbers, Revised Edition, October 1, 1952. Federal Facilities Corp., Washington, D. C.

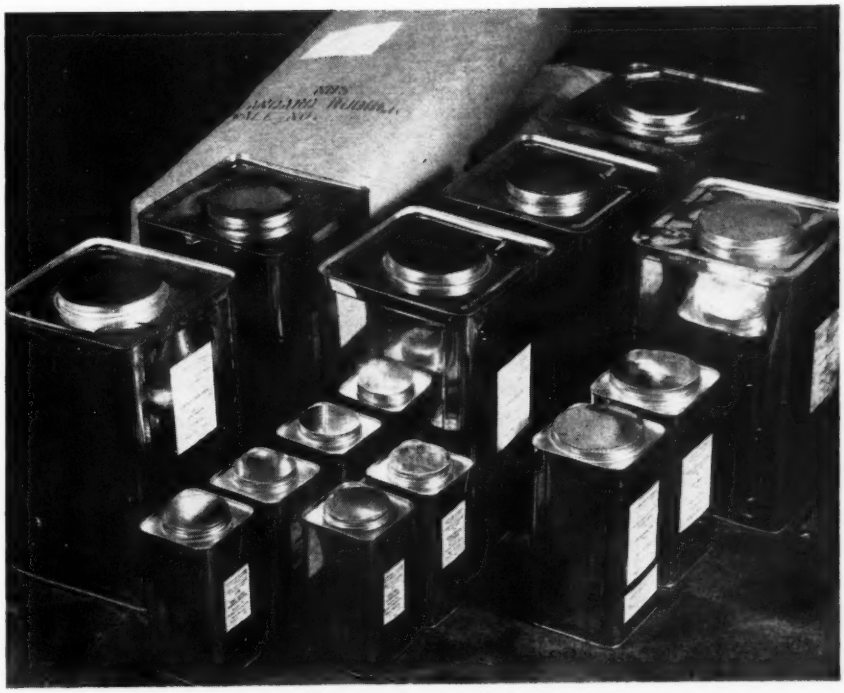
[13] Shell Oil Co. trade mark, highly aromatic oil.

[14] Golden Bear Oil Co. trade mark, highly aromatic oil.

[15] Phillips Chemical Co. trade mark, highly aromatic oil.

[16] Shell Oil Co. trade mark, aromatic oil.

NBS Adds SBR 1000 and 1500 to Standard Samples



Standard samples of rubber and rubber compounding materials available from the National Bureau of Standards. The two synthetic rubber samples *(rear)* are available wrapped with polyethylene film and packaged in multiwall paper bags. The other samples are packaged in airtight metal containers.

TWO synthetic rubbers have been added to the National Bureau of Standards' list of standard materials for rubber compounding. They are SBR[1] types 1000 and 1500, the first rubbers issued as standard samples.

The two copolymers of styrene and butadiene are used as reference standards in the formulations given in ASTM Designation D15-55T and in specifications for synthetic rubbers. They are compressed into bales of approximately 34 kilograms (75 pounds), wrapped with polyethylene film, and packaged in multiwall paper bags. Type 1000 is priced at $23 a bale and type 1500 is priced at $27.

Type 1000, designated as No. 387 in the NBS list of standard samples for rubber compounding, is the remainder of reference rubber X-768 GR-S established in 1955 by Federal Facilities Corp., Office of Synthetic Rubber. It is polymerized at a temperature of 50° C.

Type 1500, designated as No. 386 in the NBS list, is polymerized at a temperature of 6° C. It will replace X-761 GR-S which has been depleted for some time. Standard Sample 386 was selected from the central portion of a carefully prepared lot of Type 1500 styrene-butadiene rubber. Approximately 30,000 gallons of latex were blended and then coagulated on one finishing line. The standard sample was taken after about 3,400 kilograms of rubber had been coagulated. Rubber appearing to have excessive moisture was not included in the standard sample.

The results of tests on Standard Sample 386 were compiled in a report to ASTM Committee D11, Subcommittee XIII on Synthetic Rubber. Written by F. L. Roth and R. D. Stiehler, it is available as National Bureau of Standards Report 4919, dated November 9, 1956.

The tests were made at the National Bureau of Standards and at 13 plants producing styrene-butadiene rubber. A summary of the probable values (95% confidence) for NBS Standard Sample 386, compared with the mean values of the old X-761, tested simultaneously, appears in Table 1.

A total of 15 standard samples for rubber compounding is now available from NBS, Nos. 370 to 382.

[1]ASTM Designation D1418-56T—Nomenclature for Synthetic Elastomers and Latices. American Society for Testing Materials, 1916 Race St., Philadelphia, Pa.

successively, are zinc oxide, sulfur, stearic acid, benzothiazyl disulfide, tetramethylthiuram disulfide, channel black, light magnesia, phenyl beta-naphthylamine, oil furnace black, conducting black, calcium barbonate, calcium silicate, and gas furnace black.

The series was initiated in 1948 at the request of the Office of Rubber Reserve, Reconstruction Finance Corp. It consisted originally of seven compounding ingredients used in the quality control of synthetic rubber production. Later the American Society for Testing Materials, Committee D-11 on Rubber and Rubber-Like Materials, requested the Bureau to prepare additional standard samples for use in testing and quality control of other raw materials. The committee also sponsored the establishment of Standard Sample No. 386.

According to NBS, the preparation of the standard samples for rubber compounding necessitated the development of special laboratory processing and testing equipment. Special mill rolls were designed and constructed for maintaining uniform surface temperature during the mixing of the rubber compound.[2] The mold used for curing the rubber at NBS was machined directly into the hot plates of the vulcanizing press, and controls were installed for keeping the temperature during vulcanization within 0.1° C. Improvements were also made in the Mooney viscometer,[3] and a strain tester[4] was developed to attain the necessary test precision.

TABLE 1,

	X-761	No. 386
Mooney viscosity, ML 1+4(100° C.)		
Rubber	49.8	52.5 ± 1.0
Compound	61.0	61.2 ± 0.2
Viscometer cure, min.		
Characteristic (144.4° C.)		
Incipient cure time, t_s	11.9	11.7 ± 0.1
Cure index, Δt	7.0	6.8 ± 0.1
Stress at 300% elongation, psi.		
Cure time, 25 min.	370	380 ± 10
50 min.	910	965 ± 20
100 min.	1390	1400 ± 20
Stress at failure, psi.		
Cure time, 25 min.	2540	2590 ± 70
50 min.	3890	4050 ± 90
100 min.	3940	3880 ± 120
Ultimate elongation, %		
Cure time, 25 min.	945	950 ± 10
50 min.	695	685 ± 10
100 min.	555	550 ± 10
Strain @ 400 psi., %		
Cure time, 25 min.	360	362 ± 6
50 min.	205	154 ± 3
100 min.	154	154 ± 1
Electrical resistivity, megohm-cm.		
Cure time, 100 min.	86	64 ± 5

[2] RUBBER WORLD, 132, 482 (1955).
[3] India RUBBER WORLD, 112, 548 (1945); *Ibid.*, 128, 339 (1953). *ASTM Bulletin* No. 195, 45, 51 (1954).
[4] *J. Research NBS*, 41, 87, 95 (1948).

First NSF R&D Fund Report

The first in a new series of reports entitled "Reviews of Data on Research and Development" has been released by the National Science Foundation, Washington, D. C.

Called "Expenditures for Research and Development in the United States, 1953," the report analyzes research-and-development expenditures of the various sectors of the economy—the Federal Government, industry-oriented organizations, colleges and universities, and other institutions, such as privately endowed foundations — both as sources of research and development funds and as performers of research and development.

The Foundation estimates that $5.4 billion was spent in 1953 for research and development, representing 1.5% of the gross national product of $363.2 billion. The Federal Government and the industry-oriented sectors participated about equally as sources of funds: $2.8 billion by the government, and $2.4 billion by industry. Together these two sectors furnished about 96% of all research and development financing.

Colleges and universities provided 3% of the funds, $130 million; while "other institutions" provided 1%, $50 million. With reference to the college-university figure, the report notes, the $130 million does not reflect such unidentifiable contributions as salaries of principal investigators and other substantial contributions made by education institutions.

As performers of research and development, the industry-oriented sector spent almost three-fourths of the total funds; the Federal Government only 18%. Colleges and universities emerge predominantly as performers rather than as sources of funds.

Determination of Oil

(*Continued from page 720*)

higher variance with PBNA than with BLE is characteristic of the system or of the instrumentation.

Summary and Conclusions

Although some changes in the procedure, especially for stabilizer determinations when the stabilizer is PBNA, may be needed, the method of analysis appears to be a promising one either as a specifications or process control method.

Although the method appears somewhat complex, it must be noted that once the standard solutions are prepared, actual sample determinations are simple and rapid. Particularly as a process control method, where a large number of determinations on samples containing the same oil and stabilizer is to be made, the procedure is not too time-consuming. Further experience will show how long stock solutions, and solutions prepared for absorbency index determinations, will remain stable.

MEETINGS and REPORTS

Southern Rubber Group Panel Discussion on "Compound Design"

The program for the initial meeting of the Southern Rubber Group, held in New Orleans, La., November 16 and 17, 1956, included two panel discussions, one entitled "Compound Design," and the other, "Elastomers for Specific Applications." An edited transcript of the panel discussion on "Compound Design" has been prepared and is presented herewith. A similar transcript of the panel discussion on "Elastomers for Specific Applications" will be presented in our March issue, according to present plans.

The moderator for this discussion on "Compound Design," was M. H. Laatsch, Goodyear Tire & Rubber Co. Members of the panel were R. W. McCullough, American Cyanamid Co.; R. H. Gerster, Monsanto Chemical Co.; L. M. Baker, General Tire & Rubber Co.; F. W. Wilcox, Witco Chemical Co.; K. M. Romick, J. G. Milligan Co.; J. E. Stonis, C. P. Hall Co. of Illinois; and R. A. Emmett, Columbian Carbon Co. The moderator and the panelists for this discussion are shown in the accompanying photograph.

Other details of this initial meeting and organization of the new Southern Rubber Group appeared in our December, 1956, issue, page 442.

Organic Accelerators

By R. W. McCullough

American Cyanamid Co., Bound Brook, N. J.

THE 50 some odd different chemicals in current use to varying extents as accelerators may be classified as follows: (1) aldehydeamines; (2) guanidines; (3) thiazoles; (4) thiazolines; (5) thiuram sulfides; (6) dithiocarbamates; (7) mercaptoimidazolines.

The accelerators used in the largest volumes fall in classes 2, 3, 5, and 6. A great deal of detailed information on the compounding characteristics of the individual members of these classes of accelerators is available from the suppliers. The following brief discussion of the chemistry and compounding characteristics of the various classes will serve as a stimulus for further inquiry.

(1) Aldehydeamines

The aldehydeamines are reaction products of various aldehydes and primary amines. They are usually complex in structure and are frequently of polymeric nature so that it is not always possible to give useful structural formulae for these accelerators. In appearance aldehydeamines vary from brown resins to amber-colored liquids. They show varying degrees of discoloration, and some of them cannot be used in the best white rubber compounds.

In general the aldehydeamines are effective high-temperature accelerators which offer a wide range of curing or vulcanizing rates and scorching characteristics while providing vulcanizates with good aging.

In the 1920's and early 1930's a number of the aldehydeamines were used fairly extensively, but there appears to be no very extensive use of this class of accelerators at the present time.

Typical aldehydeamine accelerators are condensation products of butyraldehyde-aniline and heptaldehyde-aniline.

(2) Guanidines

The diaryl guanidines are all-purpose accelerators for natural rubber and accelerator activators or secondary accelerators for styrene-butadiene (SBR)[1] and acrylonitrile-butadiene (NBR)[1] copolymers. These guanidines became available and were extensively used through the 1920's. At the present time the guanidines are chiefly used as secondary accelerators with the thiazoles. Examples of this class are diphenyl guanidine and diorthotolyl guanidine.

(3) Thiazoles

The thiazoles are effective accelerators, for medium and high temperatures. They offer a wide range of curing rates and scorching characteristics in natural rubber and SBR and NBR copolymers.

The base of this class of accelerators is mercaptobenzothiazole (MBT) made from aniline, carbon bisulfide, and sulfur.

Mercaptobenzothiazole became available to the rubber industry in 1925, and by the early 1930's it was being used in greater volume than any other accelerator. Mercaptobenzothiazole and a number of its derivatives have continued to have very extensive use so that at present the thiazoles are used in much greater volume than any other class of accelerators.

A number of the most commonly used thiazoles are mercaptobenzothiazole, benzothiazyl disulfide, zinc salt of mercaptobenzothiazole, and several sulfenamides of mercaptobenzothiazole.

(4) Thiazolines

At present only one thiazoline type accelerator is on the market, 2-mercaptothiazoline. It is made from ethanolamine and carbon bisulfide. It is an all-purpose accelerator for rubber and styrene-butadiene copolymers, but it has not been used very extensively since the introduction of reinforcing furnace black.

(5) Thiuram Sulfides

A number of thiuram sulfides are known, and several have had fairly extensive use as ultra-accelerators for many years. One of the thiuram sulfides (TMTDS) has been in use for more than 30 years.

These thiuram sulfides are derived from the appropriate secondary aliphatic amines and carbon bisulfide. Tetramethylthiuram disulfide (TMTDS) is made from dimethylamine and carbon disulfide.

Two of the outstanding thiuram sulfides will suffice to illustrate this class of accelerators: tetramethylthiuram monosulfide and tetramethylthiuram disulfide.

(6) Dithiocarbamates

The dithiocarbamates are all ultra-accelerators with varying degrees of activity. Many of them have been known and in use for many years. The most active are metal salts or amine salts of dithiocarbamic acids derived from secondary aliphatic amines and carbon bisulfide.

Several of the most commonly used dithiocarbamates are zinc dimethyl dithiocarbamate, zinc diethyl dithiocarbamate, zinc dibutyl dithiocarbamate, selenium diethyl dithiocarbamate, and piperidenium pentamethylene dithiocarbamate.

[1] Nomenclature for Synthetic Rubbers and Latices, ASTM D1419-56T, American Society for Testing Materials, Philadelphia, Pa.



Moderator and panelists for "Compound Design" panel discussion

(7) Mercaptoimidazolines

Several years ago a member of a new class of chemicals became available which is particularly useful as an accelerator in Neoprene Type W. The commercial example of this class is 2-mercaptoimidazoline.

General Comments

Additional information on accelerators and curing systems is available from the Akron Rubber Group "Accelerators-Curing Systems" symposium of April, 1956.[2] Reprints of this have been widely circulated.

Interest in the peroxide system of curing has been developing in recent years. The advantages inherent in this system are the complete lack of color imparted, the related non-staining characteristics of the stocks, the outstanding resistance to compression set and the excellent low-temperature properties that can be obtained. The disadvantages are the inability to cure in the presence of large volumes of air and the lack of auxiliary agent which will either accelerate or retard the curing action.

The use of atomic radiation as a means of vulcanizing elastomeric materials has also been discussed recently. Since such a system could use waste products of the process of atomically producing electrical power and eliminate the use of chemical vulcanizing agents, it is a potential threat to put all of the suppliers of accelerators for rubber vulcanization out of business. No practical system for this process has been devised, however; so you will probably continue to receive visits from rubber chemical salesmen for years to come.

Questions and Answers

Q. What are the relative costs for accelerators for SBR 1500 *vs.* SBR 1502 in a typical tread stock?

A. Our answer to this question is based on government specification sheets for these two polymers. SBR 1500 would require more accelerator than SBR 1502. The accelerator cost ratio is approximately 67% if the additional stearic acid required in SBR 1500 is not included and 58% if it is. On this accelerator basis, however, SBR 1502 does not develop equivalent modulus. To obtain equivalent modulus, a higher accelerator dosage would be required for SBR 1502, and the cost ratio would come closer to 83% and 72%. The reason for the difference in accelerator ratio between the two polymers probably stems from the fact that 1500 uses a straight rosin acid soap emulsifier, while 1502 uses a mixed fatty acid rosin acid soap emulsifier.

Q. Has any work been done on continuous vulcanization of extruded products such as hose and various other cross-sections (other than wire)? What rubbers are used, and what are the acceleration and the space required for the equipment used?

A. Other than insulated wire, the only continuous-vulcanization processes we are familiar with are latex thread, belting, and foamed latex sheet. These, of course, do not fall into the category of extruded products in question. If such work is being carried out, the acceleration and equipment would have to be tied in to the desired properties of the finished product.

Q. How would you design a natural rubber compound with low filler loading that would have exceptionally good bin storage with low sulfur (max. 1%) without using sulfur bearing accelerators such as the thiurams?

A. We feel that a stock containing a maximum of 1% sulfur would require some sulfur bearing accelerator. We have used a stock for antioxidant evaluation which has a loading of only 12 parts TiO_2 per 100 RHC using 0.5% MBT, 0.5% MBTS, and 0.15% TMTDS. To improve the bin storage of this stock even more, 1.0% MBTS and 0.15% TMTDS could be used. This would probably slow down the cure rate somewhat, particularly if the curing is carried out at below 280° F.

Q. Are there any new concepts on acceleration, or retarder-accelerator combinations that will provide greater scorch safety during processing of tread type compounds using ISAF blacks?

A. A new sulfenamide accelerator, diisopropyl benzothiazole-2-sulfenamide[3, 4] was recently announced which has exceptional delayed action when used in natural rubber-ISAF black or SAF black tread stocks. With SBR-ISAF or SAF black combinations N-oxydiethylene benzothiazole-2-sulfenamide,[5] and this material plus 10% MBTS,[6] or N-cyclohexylbenzothiazole-2-sulfenamide[7] would probably give satisfactory protection against scorch.

We feel that the choice of the proper delayed-action accelerator should eliminate the necessity of the use of an additional retarder. When a small additional safety factor is required, however, and it is desirable not to reformulate completely, the use of a nitroso-diphenylamine-type retarder can add one or two minutes' extra scorch protection; 0.5% is probably the maximum economical addition for this type of retarder protection.

[2] RUBBER WORLD, May, 1956, p. 241.
[3] DIBS, American Cyanamid Co. trade mark.
[4] DIPAC, Pennsylvania Salt Mfg. Co. trade mark.
[5] NOBS Special, American Cyanamid trade mark.
[6] NOBS No. 1 = NOBS Special + 10% MBTS, American Cyanamid trade mark.
[7] Santocure, Monsanto Chemical Co. trade mark.

Antioxidants

By R. H. Gerster

Monsanto Chemical Co., Akron, O.

THE unsaturation of natural and synthetic rubbers makes it possible to achieve good physical properties by vulcanization. The unsaturation, however, also furnishes centers of attack for oxygen or ozone. This action is activated by heat and results in a deterioration of physical properties.

We cannot determine the mechanism of oxidation, but a generally accepted theory is that oxidation proceeds as a free-radical chain reaction. This results in either scission of the polymer molecules, or in cross-linking. Any material which inhibits scission or cross-linking is called an antioxidant.

A great many possible free radicals are involved in oxidation. As may be expected, different antioxidants have different effects on these radicals. For example, some antioxidants excel in resistance to heat, and some will retard flex crack growth more than others. No two materials seem to act exactly alike.

Natural rubber contains a natural antioxidant which inhibits oxidation in the uncured state, but it is destroyed by vulcanization. Synthetic rubbers require the addition of antioxidants during their production to prevent rapid oxidation during manufacture and storage. Although these remain effective after curing, additional antioxidants are generally added to give better durability to the finished goods. This is particularly true of styrene-butadiene rubber tire tread compounds. Additional antioxidant helps prevent gel formation during hot processing. The presence of excess gel lowers cut growth resistance.

The consumption of antioxidants has increased steadily over the past 20 years, and they are now being used in an amount slightly less than 2% by weight of all new rubber used. We can now list better than 200 different commercial antioxidants, exclusive of waxes.

Classification

Antioxidants can be classified in the following groups: (1) ketone-amines; (2) secondary diarylamines; (3) substituted diphenylamines; (4) p-phenylenediamine derivatives; (5) secondary alkarylamines; (6) substituted phenols; (7) phenolic sulfides; (8) phenyl alkanes; (9) phenolic derivatives; (10) thiazyl and imidazyl derivatives; (11) mixtures; (12) miscellaneous; (13) waxes.

The best specific antioxidant or combination for any particular product can best be found by comparison of different ones in service. Accelerated aging tests in the laboratory are used for screening and for indicating the probable relative merits of different antioxidants.

Attention has more recently been focused on the attack on rubber products by ozone. There is no doubt that this has become more critical because of the increased pollution of the atmosphere by industrial wastes. Such polluted air promotes the presence of ozone or similarly acting oxides. The basin occupied by Los Angeles, Calif., is particularly bad in providing an atmosphere which at times approaches 100 parts of ozone per 100 million parts of air.

The action of ozone on rubber is not the same as the action of oxygen, and most antioxidants are not effective in preventing ozone cracking. Some of them seem to promote cracking. Although ozone probably has some effect on unstressed rubbers, it is not usually apparent unless the material is stressed. Cracking then occurs in such a way as to relieve the stress.

Ozone cracking can be prevented by a protective wax film. This method is effective for static service, but if any flexing is involved, the wax film may be ruptured. The ozone attack then becomes concentrated where the film is broken, and the cracks are usually wider and deeper than if there were no wax. Fortunately, there are now antiozonants which are effective even for dynamic service.

An antioxidant and antiozonant used for SBR and natural rubber tire treads and black sidewalls is 6-ethoxy-1,2-dihydro-2,2,4-trimethylquinoline.[8] Some paraphenylene-diamines are very effective for SBR stocks. Antiozonants seem to protect the polymer by a chemical action, and they also form a protective resinous film. The formation of the latter is aided by the presence of saturated waxes. Many sidewalls and some tread compounds now contain 1½ to 2% of a fairly high melting point wax. This amount greatly improves the resistance to static cracking and affects the resistance to dynamic cracking only slightly.

Research laboratories continue to screen all possible compounds for antioxidant and antiozonant value. Many new materials have been put on the market in recent years. The goal of finding an effective, nonstaining, non-discoloring antiozonant which will provide good heat resistance and prevent crack growth is something just to dream about, but the search will continue.

Questions and Answers

Q. What type of polymer and antioxidant combination would be best for nonstaining and non-discoloring light-colored stock under both warehouse storage and exposure to weather?

A. SBR 1502 is probably the best polymer, and a combination of paraffin and micro-crystalline waxes would give the best protection in warehouse or exposure to weather. The amount of waxes used will depend upon the amount of load and plasticizer. For severe service or the more lightly loaded stocks, 4,4′-thiobis (6-tert-butyl-*m*-cresol),[9] 4,4′-butylidene bis (6-tert-butyl-*m*-cresol),[10] or 2,2′-methylene-bis (4-methyl-6-tertiary-butyl phenol)[11] would be best for additional protection.

Q. What is the time-ozone concentration relation necessary to produce noticeable cracking in black passenger and truck tires when stacked horizontally in storage?

A. For a given ozone concentration there is a critical elongation necessary to allow cracking to start. For a given type and amount of antiozonant or combination of wax and antiozonant there is a critical ozone concentration necessary to initiate cracking. Once these two critical conditions are exceeded, the time to produce noticeable cracking is inversely proportional to the ozone concentration in pretty much of a straight-line function. It should be remarked that in at least one instance of tires stacked in a West Coast area of fairly high ozone concentration, cracking was observed in less than 48 hours.

Q. When will a non-staining, non-discoloring antiozonant be on the market?

A. If we can judge by the amount of effort in our research department and others are also working diligently on this problem, such an antiozonant will eventually be available. We have had some indications that the problem is not insolvable, but so far nothing of definite commercial value has been developed. We cannot say at this time, however, when the goal will be reached.

Q. Is there any way to prevent discoloration found in the back end of a car caused by the present antiozonant being used?

A. The general anxiety here is from the known property of 6-ethoxy-1,2-dihydro-2,2,4-trimethyl quinoline[12] to migrate through closed air space to cause discoloration of certain types of lacquers such as those containing nitrocellulose. Fortunately most types of automotive finishes do not have this tendency to discolor under such conditions. Santoflex AW will cause migration stain around areas where direct contact is made with the automotive finish. We have not, however, heard of any discoloration of the back end of cars caused by Santoflex AW. If such should occur, a change in the automotive finish should be considered.

[8]Santoflex AW, Monsanto trade mark.
[9]Santowhite Crystals, Monsanto Chemical Co. trade mark.
[10]Santowhite Powder, Monsanto trade mark.
[11]Antioxidant 2246, Monsanto trade mark.
[12]Santoflex AW, Monsanto trade mark.

Equipment and Processing

L. M. Baker

The General Tire & Rubber Co., Akron, O.

PERHAPS more than any other subject on our program this morning "Equipment and Processing" affords a common meeting ground for all compounders, production men, engineers, suppliers, purchasing agents, and other specialists in the rubber industry. In this age of specialization, and larger and larger companies, people are becoming to know more and more about less and less. This situation exists in the various companies as well as in the whole industry, and meetings such as this one can be helpful in bringing about a better understanding among these specialists.

A football squad that has much separate coaching of backs, ends, tackles, and so forth, will win many games on Saturday only if they practice together often and long as a team. We need this same teamwork of specialists in companies and in the industry. When we consider equipment and processing in its broader aspects, we find understanding and cooperation of many groups to be of paramount importance.

Each subject on this program could and possibly should be a subject for a future full meeting. Therefore in the very little time allotted this morning, we can make briefly only some general comments in regard to current trends and new developments for the future.

More nearly continuous operations and more highly automated equipment are constantly being developed. Today, many operations which were formerly separate or isolated operations are now combined into a single operation. An example of this, which is now quite common, is stock mixing, fabric treating, and calendering. Automatic compounding and mixing of stock is another example of this trend towards automation. The following discussion, however, brief as it is, will give some further details of such equipment and processes.

Automatic Compounding

In addition to equipment manufacturers and plant engineers, the compounders, production men, and oftentimes the purchasing agents and suppliers become involved when automatic compounding and stock mixing operations are adopted. Some preceding processes must be changed; some materials must be modified; and some compounding changes are required before even this relatively new development can be utilized.

Rubber and/or masterbatches must be put into pellet form so that the weighing operations can proceed rapidly and accurately. The handling characteristics of some materials must be modified so that they can be weighed and handled on the new-type equipment satisfactorily. Some compounding ingredients are used in such small quantities that the compounders may have to blend these materials with other materials in order to have a large enough quantity going into the batch so that the necessary weighing accuracy can be achieved.

Most companies now using automatic compounding equipment prepare the rubber and/or masterbatches in pellet form; some suppliers are now furnishing reclaim in powder or pellet form, and it may be possible that in the future synthetic rubber producers may be requested to do the same. Synthetic rubber delivered in flowable form could be an important contribution toward progress in this field.

This rather new development, automatic compounding, has many advantages and disadvantages, which will differ widely from plant to plant, depending upon size and upon number of different kinds of products manufactured. Careful consideration must be given to the economic factors of capital expenditure *versus* labor savings, maintenance expense, product quality, uniformity of stock, and efficiency of utilization of equipment in subsequent operations.

Many claims have been made for improvement in uniformity of the mixed stock because of reduction of the possibility of human error; but perhaps the greatest need of the automatic weighing and handling equipment is in connection with full utilization of some newer mixing equipment which operates on such short time cycles that automatic weighing and handling becomes almost a necessity.

High-Horsepower Mixing

The high-pressure, high-horsepower, high-speed Banbury mixing of stocks is receiving much consideration throughout the industry. The principle of this type of Banbury mixing is to apply high pressure to the batch to bring about very rapid incorporation of the materials into the rubber while the rubber is still cold and viscous. It is necessary to have enough horsepower to operate the Banbury mixer under such conditions. The high horsepower consumption, however, does cause a rapid temperature rise, and it has been found desirable to terminate the mix upon reaching a certain temperature level rather than depending upon a fixed time cycle.

It has been reported that approximately a 40% reduction in mixing time may be achieved with this-type mixing equipment. It should be pointed out that this is a reduction in mixing time and does not include the loading and unloading part of the mixing cycle.

Mixed Stock Handling

Naturally, the faster mixing cycles achieved with the high-horsepower Banbury have brought about a problem with respect to handling the mixed stock. Not only to handle this stock more speedily, but to handle stocks which do not band readily on a mill, slab extruders or pelletizers have been developed for these purposes. Either of these machines receives the batch directly from the Banbury and replaces the mill ordinarily located under it.

A slab extruder usually extrudes a circular, thin-gage form, which is then slit into a slab and cooled in conventional equipment. The pelletizer prepares masterbatches of mixed stocks in pellet form for either mixing into final mixed stock or for delivery to the next processing operations. The pellets of final mixed stock can be used very readily for automatic continuous feeding of warm-up mills for calenders and tubers.

Calender Roll Bending

The modern four-roll "Z"-type adjustable cross-axis calender, although not entirely new, has done much to solve the problem of maintaining uniform gage across the face of the calender when running a variety of stocks from relatively soft unloaded to relatively tough highly loaded compounds.

Although in use for the past five years in the plastic industry, a new solution to the crown problem will soon be tried in the rubber industry. This innovation is known as "roll bending." By this method, loads are applied hydraulically to bearings which are placed on the outside of the regular bearings and which apply a force that will cause the roll to bend in a direction opposite to the load placed upon the roll while in service. This reverse action counteracts the bending of the roll in service and produces a flat sheet across the face of the roll. The hydraulic force can be applied also to reduce calender crown.

This calender roll bending device can be installed on some existing calenders and will give crown corrections of 0.002- up to 0.005-inch, depending upon the calender. Better control of gage across the width is also possible with this equipment when varying the gage of the sheet from thin to very thick. No doubt, this development will be followed closely because of its adaptability to existing equipment and the great savings that can be accomplished by running stocks to the proper gage.

Other Equipment

Time does not permit us to discuss some of the improvements in equipment that have been made for those operations occurring between processing and curing. There is a rather new development in curing, however, which we should mention, even though it applies only to tires. Everyone is familiar with the Bag-O-Matic[13] press, however, and developments are now under way to achieve the automatic loading and unloading of these presses. In fact, installations are already in progress on a rather large scale. This is equipment of a type which is of great value to the small plant as well as to the large, because its main advantage is that maximum press utilization can be achieved, even when employing a wide variety of curing cycles.

In closing, however, I would like to point out again that for maximum plant efficiency, with respect to equipment and processing, the utmost understanding and cooperation are required from the many groups such as the suppliers, purchasing agents, compounders, production men, engineers, and others represented here today.

Questions and Answers

Q. How widely have the high-horsepower Banbury-type mixers been adopted? What disadvantages have been encountered, if any?

A. Many companies have installed the high-horsepower Banburys for factory evaluation of them. It is my understanding that at present some companies are now installing additional Banbury mixers of this type. This fact should indicate a growing acceptance of the value of such mixers.

The main disadvantages have been the necessity of installing special equipment for loading the Banbury quickly and for rapidly handling the stock discharged from it. These changes are necessary to synchronize these operations with the shorter cycles of the high-horsepower Banbury.

Q. Are the tire plants interested in receiving all synthetic rubbers with a nonstaining stabilizer? Would such rubbers be of value in applications other than white sidewall tires?

A. On an equal quality and cost basis, the tire plants would be interested in receiving all synthetic rubber with a nonstaining stabilizer. Availability of such rubber would be helpful, not only in reducing the number of kinds of synthetic rubber in the warehouses and stores, but because it would simplify or reduce the number of stocks necessary in a tire plant. A reduction in the number of stocks to be mixed would be particularly helpful with the newer automated equipment.

Q. Has any work been done on continuous vulcanization of extruded products such as hose and various other cross-sections (other than wire)? What rubbers are used, what acceleration is required and what space is required for the equipment used?

A. Considerable work has been done on continuous vulcanization of extruded products of various cross-sections, such as profile strips for window channels, but I am not aware of any such work with hose.

I have learned that two general methods are being used for the continuous extrusion and vulcanization of certain products. In one method a die more than 10 feet in length is used to extrude the section and to cure it as the stock passes through. Considerable mechanical work is done on the stock to raise its temperature immediately before entering the die; then high temperatures in the die quickly cure the extruded product. It is my understanding that lubrication of the inside surface of the die and the method of pulling the strip from the die are important considerations in this process.

The other method uses an almost conventional die, but passes the extruded section through a heating chamber somewhat similar to that used for the CV curing of insulated wire.

Continuous vulcanization of profile strips has been accomplished with butyl, SBR, and natural rubbers. The acceleration of these stocks are of necessity very rapid and somewhat similar, I understand, to that used for wire. Such acceleration will provide safe processing stocks at temperatures of approximately 220° F., but these will cure within a few seconds at temperatures above 400° F.

The floor space requirements for this equipment are not much greater for the method using the long die, but are considerably greater for the method using the hot curing chamber immediately after the tubing operation.

[13]McNeil Machine & Engineering Co. trade mark.

Q. Give recipes and criteria for screening: (1) tire tread camelback polymers; (2) tire carcass polymers; (3) mechanical goods polymers.

A. The whole industry for many years has put forth a great effort to develop test recipes and methods, but no agreement has yet been reached, and I doubt that we can do any better here this morning.

The main problem seems to be that those people manufacturing polymers want recipes which will be very sensitive to and reflect variations or differences in the polymers. The users of these polymers would like test recipes and test results which might indicate the characteristics of the polymers in compounds such as tire carcasses, tire treads, etc. Unfortunately, these latter recipes do not, because of their design to level out variations from rubbers, accentuate the variations or differences in the polymer. We have in effect, a man and a mountain, and neither one will move toward the other. Perhaps someday we'll get together on this problem.

Q. What causes pigtails and lumps in Banbury mixing, and how can they be eliminated?

A. The two most common sources of such contamination are from around the Banbury mixer rings and sliding door. Naturally, good maintenance on the Banbury can practically eliminate these sources. As an extra safety factor, sheet metal shields can be placed in the Banbury base to deflect such materials away from the chute so that they are collected around the Banbury base instead of being allowed to fall down the chute into the batch.

Recently made improvements in the sliding door and also in dust ring designs should greatly improve the retention of materials in the mixing chamber.

Q. What are the disadvantages of completely loading the Banbury mixer at zero minutes?

A. The main disadvantage of this method of mixing sometimes called "upside down" mixing is loss of material which can occur early in the mix. Some of this material in the form of dust will come up through the throat of the Banbury and will be collected by the ventilating system. The Banbury, however, must be tight around the dust rings and at the sliding door; otherwise there will be losses of materials at those two points.

Another disadvantage is that additional load is thrown upon the Banbury, and it may stall unless sufficient horsepower be available.

There has been considerable discussion in regard to the degree of pigment dispersion attained by this method. The dispersion may be inferior if the oils are added along with the loose pigments. If the oils are injected into the Banbury, however, under pressure after most of the loose pigments have been incorporated into the batch, it is my understanding that dispersion then will be quite satisfactory.

Q. What is the minimum rest period to obtain the most satisfactory results from stocks in process (natural rubber and SBR)?

A. Good compounders can make stocks run satisfactorily either with or without rest periods between the various processing operations. Stocks can be compounded so that a continuous operation without rest periods can be used. These stocks, however, ordinarily will not be satisfactory if they are aged for a period of time between operations. Conversely, stocks which are compounded to be run with an aging period between the operations usually cannot be run satisfactorily on a continuous basis.

The important thing, I believe, in this question is to point out that the type of operation must always be the same. If the operations are not performed continuously, then for the sake of uniformity it is necessary to have a minimum of 12 hours' aging between the operations on both SBR and natural rubber stocks.

Fillers

By F. W. Wilcox

Witco Chemical Co., Akron, O.

THE demand for light-colored rubber goods has been steadily increasing over the years. This trend has been accelerated by the automobile manufacturers who have requested among other things pastel-colored weather strips and even brightly colored tires to harmonize with the color styling of their new models.

At the present time the rubber industry consumes as much, if not more, non-black pigment tonnage than carbon black tonnage. The clays and calcium carbonates represent the largest percentage of non-black pigments used, followed by zinc oxide, calcium silicate, and the reinforcing silica.

The non-black pigments can be classified into two distinct types: those that reinforce rubber—that is, increase its tensile strength, abrasion resistance, or tear resistance—and those that dilute or extend the rubber hydrocarbon. The latter serve to increase hardness and bulk, lower cost, or improve processing. Both types are equally important to the rubber industry.

As in the case of carbon black, the degree of reinforcement is determined largely by the particle size and to some extent by the particle shape of the pigment. In general, the finer the particle size of the filler the greater is its reinforcing power in rubber compounds. Particle shape affects specific properties such as tear resistance, flex resistance, and hardness. Extremely fine spherical-shaped particles generally give the best all-around properties; while flat plate-like structures (clays) or rod shaped particles (magnesium carbonate) form strata or layers which tend to increase hardness, but decrease tear and flex properties.

A great number of materials fall into the non-black pigment classification. In the handbook, "Compounding Ingredients for Rubber,"[14] more than 60 reinforcing pigments are listed, and about 100 of the non-reinforcing type. This morning we will concern ourselves mainly with the more select members of these groups.

Reinforcing Silicas

The hydrated silicas are the most reinforcing of all non-black pigments. These materials are ultra-fine in particle size and compare roughly in reinforcing properties with channel black. In rubber compounds they provide high tensile strength, modulus and hardness, with an abrasion and tear resistance that is hard to surpass even with the finest carbon blacks.

Although comparable to carbon black in many respects, the silicas lack the resilience of carbon black—thus rubber parts made with hydrated silica compounds as the prime loading tend to be stiff. Reinforcing silica pigments also retard cure and require increased acceleration and/or kickers: namely, glycols or amines to bring them into line. Used alone or in conjunction with other pigments, the hydrated silicas impart hardness and toughness to a non-black stock.

Calcium Silicate

Calcium silicate is not uncommon in nature, being found in rather pure form as "Wollastonite." It is not possible, however, to grind the mineral to a fine enough state for use in rubber.

Calcium silicates of ultra-fine particle size are prepared commercially by means of precipitation. These fine particle-sized silicates are satisfactory reinforcing pigments where high hardness and good resistance to abrasion and tear in a rubber compound are required. Although pigments of this type lack resilience in themselves, it is possible by blending with other materials to produce compounds having highly desirable properties. For instance, before the advent of calcium silicate rubber pigments it was impossible to produce high-quality non-mark shoe soles.

Clays

Clay is one of the cheapest pigments used by the rubber industry. There are two types, designated as "hard" and "soft." The main difference is in particle size.

Hard clays are reinforcing pigments since they increase tensile strength, modulus, and hardness of rubber compounds. The soft clays have larger particle size and give much lower modulus at equal loadings. Clays tend to make the stock loggy and retard cure, but they are good materials to use when you want stiffness in cured or uncured stock at low cost.

Regenerated clay is relatively new to the rubber industry. It is made by dissolving natural clay and precipitating it in a much more finely divided state. Clay made in this manner is much more reinforcing than hard clay. In fact, it is more akin to calcium silicate, with an added advantage in that no special additives are required for cure.

Zinc oxide was one of the first reinforcing pigments used by the rubber industry. Up until the time carbon black was introduced in 1912, zinc oxide was the principal reinforcing pigment for tires.

Zinc oxide is a fine particle size pigment giving moderate tensiles, high elongation, and good resilience. In many ways it is analogous to semi-reinforcing furnace black in the carbon black family.

There are two types of zinc oxide: French process and American process. The

[14] Rubber World, New York, N. Y.

zinc oxide manufactured by the French process is normally fast curing. American-process zinc oxide is slower curing and harder to disperse in rubber.

Its high resilience, low heat build-up, and excellent color stability make zinc oxide an ideal pigment for white sidewalls, motor mounts, vibration absorbers, and similar items. Its greatest usage in rubber, however, is not as a filler, but as an activator of cure for most elastomers and as a curing agent for neoprene.

Calcium Carbonate

One of the most popular non-black fillers is calcium carbonate. There are a great number of carbonates ranging from dry ground limestone with a particle size of from 20 to 40 microns on the one hand, to the ultra-fine precipitated calcium carbonates with a particle size of about 0.04-micron on the other.

The precipitated carbonates give tight snappy cures with good tensile and tear properties, low modulus, and high elongation. The resistance to abrasion, however, falls short of that obtained with the silicas, silicates, or regenerated clay. High-volume loadings can be incorporated easily without too much loss in elasticity or change in hardness. The ultra-fine carbonates are used mainly in quality products such as bathing caps, drug sundries, or household items where a snappy feel as well as good tear and tensile properties are desired.

Whiting, which is also calcium carbonate, shows little resemblance to the ultra-fine precipitated materials. Many types of whiting are available; perhaps the cheapest is dry-ground limestone selling at about $8 a ton. A slightly better grade is the water-ground type which has smaller and more uniform particles. Whiting, because of its low cost and the ability to be incorporated in large quantities in most elastomers, is used by the industry primarily as a diluent or as a filler, to reduce cost.

A somewhat different type of calcium carbonate is ground oyster shell. This material has a natural oil on its surface which enhances the extrudibility of stocks.

General Comments

We have seen that the non-black pigments act so completely different in rubber that it is possible through proper blending to develop compounds having an almost unlimited range of physical properties. Unlike carbon black, however, no single white pigment or known combination of white pigments will provide high abrasion resistance and good resilience in the same package—at least not with the present elastomers.

Questions and Answers

Q. Keeping all other factors the same, which styrene-butadiene rubber (not over 25% bound styrene) will provide the maximum degree of hardness to a flexible clay-loaded vulcanizate?

A. There would be very little if any difference between the various polymers. Possibly those SBR rubbers made with fatty-acid emulsifiers might show some advantage in a clay-loaded stock owing to slight acceleration of cure, but the difference would be negligible. Easier ways to obtain maximum hardness would be to add a small amount of high styrene resin, or possibly replace part of the clay with precipitated silica, or an even cheaper method would be to increase the amount of sulfur or accelerator in the compound.

Q. In competing with vinyl and asphalt floor tile, it is becoming more difficult to obtain low cost, both in material and labor used for the manufacture of rubber tile. Are there highly loaded compounds with short cures that could be suggested for rubber tile? The cure rate should be five minutes or less at 350° F., and compound cost less than 8¢ per pound.

A. Undoubtedly compounds can be made for less than 8¢ a pound by using a combination of hard clay and soft clay, whiting, and cellulosic fibers in loading up to 400 parts or more. It would seem that the problem here is mainly getting a safe processing stock, which might be accomplished by using ultra-accelerators such as dithiocarbamates plus an equal or greater amount of a thiazole accelerator. The thiazoles in combination with such ultra-accelerators tend to act as retarders for the ultra-accelerators during processing.

Q. In working with black cove base compounds it has been found that gas formed between the mold face and the stock, forming a spotty surface. Is any reason known for this action, and can anything be done to eliminate it? It has been noted that increasing carbon black tends to cut down the gas, while fibrous materials such as flock do not help much.

A. The spots may be due to too slow a cure. The rubber gets a chance to flow out of the mold and thus loses back pressure. A stock made stiffer with carbon black may work better. A longer cure and especially a faster cure would help remedy this condition, also. Use of silicone emulsions as mold lubricants are very helpful for conditions of this sort.

Q. What effect do the various pigments, whiting, clay, talc, etc., have on aging, sunlight cracking, and ozone resistance?

A. Most of the pigments offer no particular aging problems except perhaps those that are contaminated with manganese, iron, or copper.

We have never observed any great difference in sunlight cracking between the various pigments provided modulus of the compound is kept fairly constant.

We have noticed that the large particle size fillers such as ground limestone are somewhat poorer with regard to ozone cracking than fine particle size materials; however, these fine materials may give poor results also if they are not properly dispersed. The extent of loading seems to be more important than the type of loading. A highly loaded stock requires more protective wax than a lightly loaded stock.

Latex

By K. M. Romick

J. G. Milligan & Co., Chattanooga, Tenn.

ALTHOUGH natural liquid latex has been known to man since rubber was discovered, it is only since the turn of the century that it has been more than a scientific curiosity. Early commercial interest was centered in its function as a source of dry rubber and not as a separate commodity of trade.

As the rubber industry grew, the idea of producing rubber articles directly from latex became more attractive. New methods for the direct utilization of liquid latex were devised, and in order to supply the resulting increased demand, improved methods of preserving, concentrating, and shipping latices were developed. As a result, the latex industry grew rapidly and is still growing.

Types

Latex is a water suspension of microscopic particles of rubber or rubber-like materials. Latices are of two types, elastic and plastic. The first includes natural and the synthetic rubber latices of the SBR, neoprene, and nitrile types. Solid deposits from these are rubbery in properties in that they are resilient, can be stretched to a number of times their original length and, when released, return rapidly to about their original dimensions. The plastic latices, on the other hand, when dried or deposited, yield solid materials which, compared with rubber, are harder, much less resilient, can be stretched less, and do not return so well to their original dimensions. You are familiar with plastics, such as the vinyl resins, some of which are available in latex form.

Natural rubber latex is the milk or sap of the rubber tree from which the crude dry rubber commonly used in the manufacture of rubber articles is obtained. The latex is obtained by tapping the bark of the rubber tree and collecting the fluid in a cup. A native can collect from 5-10 gallons of latex per day from 200-300 trees. A fresh cut must be made each day in the bark of the tree, and the latex carefully collected from the cups into bulking tanks. The original latex must be preserved with ammonia or some other chemical such as sodium hydroxide or sodium pentachlorophenate, then concentrated by centrifuging, creaming, or evaporating. The original concentration varies from 35 to 40% rubber content and is increased to 60-63% by the above methods. Most of the latex used in this country is concentrated by centrifuging. It is interesting to know that the rubber particles in this latex average about 4/100,000 of an inch in diameter. It is estimated that one drop contains more than 10,000,000 particles of rubber.

Synthetic rubber and plastic latices are made in chemical plants where monomers, in the presence of other necessary chemicals and emulsified in water, are polymerized to latices resembling natural rubber latex. The particle sizes of many of these latices are even smaller than the particle size of natural rubber latex.

Compounding

Before a latex can be utilized for the

manufacture of rubber products, it is necessary to add materials capable of improving the physical and chemical properties of unvulcanized latex. In addition to sulfur, accelerators and activators of vulcanization, it is common practice to add to the latices antioxidants to make the articles age well, and fillers, colors, and softeners to give special properties. Such materials cannot be added directly to the latices, but must be either dissolved in water or dispersed to a particle size comparable to that of the latex. Such dispersions are made in ball mills or colloid mills. Liquids, semi-solids, and low melting solids are emulsified in water in homogenizers and colloid mills.

Latex compounding is an art in itself. While it follows the general lines of the familiar dry rubber compounding procedure, some vital differences must be observed. The quantities of various ingredients required to obtain a desired result are usually less in latex compounding than in dry rubber. The various latices usually require different types and different amounts of compounding ingredients. Each compound is tailored to meet specific requirements.

Processing

In making rubber articles latex compounds have several advantages over dry rubber compounds. Less power and equipment are required. Articles of better quality and often of better appearance can be made. Many articles too complicated to be made by molding solid rubber can be manufactured from latex. Latex compounds eliminate fire and toxic hazards present in the production of dipped or spread goods from solvent systems of dry rubber.

After satisfactory latex compounds have been made, they can be used in a wide variety of processes to manufacture a great many articles. Latex can be used in spreading, impregnating, casting, spraying, and dipping. Articles such as surgical, household, and electricians' gloves, rubber thread, mattresses, pillows, baby pants, drug sundries, catheters, tubing, blood-pressure bags, anaesthesia equipment, balloons, both toy and meteorological, dolls, toys, balls, and many others are made from latex compounds. Specially compounded latex is used to make sponge rubber, to treat paper and textiles, to coat wire and metals. One of the largest single uses of latex is the coating of carpets and fabrics with rubber.

Questions and Answers

Q. What are typical latex compounds for foam sponge, for rug backing and impregnation, and for non-discoloring films?

A. FOAM SPONGE. Many compounds are used for foam sponge, based on all natural latex, on combinations of natural and hot and cold SBR latices, and on neoprene latex. Recipes vary, depending upon the end-use of the foam sponge and upon the process used to produce it. The Dunlop and the Talalay processes are most widely used for the manufacture of latex foam.

In the former method a typical formula using natural latex would be to deammoniate the latex and add one part of potassium oleate soap, sulfur, zinc diethyldithiocarbamate, zinc mercaptobenzothiazole, zinc oxide, and a gelling agent such as sodium silicofluoride.

By the Talalay method the latex is foamed by the decomposition of hydrogen peroxide, frozen and set with carbon dioxide.

RUG BACKING. There are many formulations for rug backing and impregnating of paper, fabric, cord, etc. Compounds are based on natural latex, the SBR latices, neoprene latex, the nitrile latices, and the vinyl-resin types, as well as combinations of the first two.

For rug backing compounds, fast-curing accelerators must be used and usually high loading of clays, along with the usual stabilizers and antioxidants. Compounds are tailor-made to suit specific requirements of the fabric and the method of applying the compound.

In impregnating applications there is ever more need of special formulations, depending upon the type of material being impregnated and the end-product desired. To attempt to give any formula, other than one for a specific need, would be meaningless.

NON-DISCOLORING FILMS. A specific formula for producing a non-discoloring film would be one containing natural latex, stabilizers such as potassium hydroxide, sulfur in amounts less than one part, accelerators such as zinc dimethyl dithiocarbamate and a zinc salt of mercaptobenzothiazole, and a non-staining antioxidant such as 4,4'-butylidene-bis (6-tert-butyl-*m*-cresol)[10] or diortho-tolylethylene diamine.[15]

Q. What compounding factors cause or inhibit discoloration of latex films?

A. Some of the factors that cause discoloration of such films are the staining characteristics of most antioxidants and accelerators and improperly preserved latex, especially if this improper preservation occurred when the latex was first tapped and stored.

Q. What are the relative merits of hot vs. cold SBR latices in rug backing and cord dipping applications?

A. Cold SBR latices have several advantages in rug backing compounds over the hot latices in that they have less odor, tend to cure faster, and are available at higher concentrations.

The cold latices, moreover, tend to produce better physical properties in cord dipping.

[15]Stabilite Alba, C. P. Hall Co. trade mark.

Plasticizers and Tackifiers

By J. E. Stonis

The C. P. Hall Co. of Illinois, Chicago, Ill.

PLASTICIZERS are in much wider use now than when natural rubber was the only elastomer available. As you all know, natural rubber has certain specific properties and requires only small limited amounts of plasticizers. As synthetic elastomers were developed and introduced, this thinking changed because wider and more diversified applications had to be found. These synthetic elastomers had to be modified, and this modification was accomplished by use of plasticizers. Today, hundreds of plasticizers are being used for thousands of end-products.

Plasticizers not only act as softeners, processing aids, extenders, and peptizing agents, but also as cost reducers. Plasticizers are varied in composition and in cost; prices ranging from 10¢ per gallon to $1-plus per pound. It is the aim of every compounder to manufacture his product at the lowest possible price and yet obtain the best physical properties. Unfortunately, we are still in the process of finding a single, economical plasticizer that will work with all of the elastomers, imparting the desired qualities for each and every application.

The compounder has little trouble finding a satisfactory plasticizer when only a single property is required, but when a combination of properties is desired, the problem generally becomes more difficult. Many rubber recipes contain a combination of two or more plasticizers to obtain the specified physicals. Most rubber plants are stocking and using numerous plasticizers. Their inventories range from tanks down to single drums and cans. It is very important for the compounder not only to select the proper plasticizer or blends thereof, but also to determine the correct amounts for imparting the desired end-products at the lowest possible cost.

Plasticizers tend to reduce mixing and processing temperatures, lower power costs, aid in incorporating and dispersing dry ingredients, reduce nerve, improve flow during molding, help in extrusions, and exert other effects in physical properties. The presence or elimination of a plasticizer will alter many physicals, such as: tensile strength, modulus, elongation, hardness, heat loss, low temperature flexibility, heat resistance, flame resistance and water, solvent and oil extractability.

Classification

Where do we obtain these plasticizers, and what are they? They come from every category of chemicals known to man. Plasticizers are designated or classified as follows: hydrocarbons, esters, ethers, chlorinated hydrocarbons, phenols, vegetable oils, fatty acids, pitches, petroleum products, pine products, resins, coal-tar products, waxes, and other miscellaneous groupings.

These same plasticizers can then be reclassified as to type, that is, solvent, partial solvent, and non-solvent type. The specific elastomer involved will determine the type of plasticizer required. Strong solvent types generally tend to produce snappy stocks; lower solvent types produce smoother

stocks with possible "bleeding" for better extrusions. Plasticizers with high boiling points and low vapor pressures generally impart low volatility during processing, aging, storage, and use. Melting points, freezing points, and viscosities of plasticizers aid in incorporation and also influence flexibility. Solubilities of plasticizers generally determine the rate of extractability.

Application

For natural rubber compounding, the following plasticizers are most widely used: light process oils, soft asphalts, pine products, pitches, resins and, esters. Range of use is 2-15 parts.

For SBR rubber compounding, the following plasticizers are strongly recommended: light process oils, soft asphalts, styrene resins, pine products, naphthenic base oils, aromatic oils, coal-tar products, resins, and numerous esters. Range of use is 5-30+ parts. As you can see, considerably more plasticizer is required for SBR than for natural rubber. I might mention that in the process of manufacturing oil-extended SBR stocks, as much as 50 parts of process oils are added at point of production.

For neoprene rubber compounding, the following plasticizers are suggested: light process oils, liquid asphalts, rosin and their derivatives, coal-tar products, resins, and various esters. Range of use is 5-30 parts.

For chlorosulfonated polyethylene[16] the following plasticizers are suggested: light process oils, high aromatic oils, resins, and some esters. Range of use is 5-20 parts.

For butyl rubber compounding, the following plasticizers are recommended: paraffinic distillates, polybutenes, metallic salts of fatty acids, hydrogenated rosin derivatives, resins, and certain esters. Low unsaturation and low polarity are necessary for best results. Range of use is 5-25 parts.

For nitrile rubber compounding, many plasticizers are suggested. Those preferred are: aromatic oils, esters, resins and non-polar-type derivatives. Changing the type and the amount of plasticizer in recipes enables one to meet certain specifications, for example:

AMS[17]-3212-F will pass with 7% of dibutyl sebacate.
AMS-7271 will pass with 5% of polyethylene glycol of di-2-ethyl hexoate.[18]
AMS-3202-E will pass with 20% of high molecular weight polyester.[19]
AMS-3211 will pass with 8% of glycol ester of vegetable-oil fatty acid.[20]
AMS-7260 will pass with 10% of dioctyl adipate.

Tackifiers

Because most of the synthetic elastomers do not possess the desired amount of tack, we must make or produce this property by the addition of the proper chemical, if possible. Very few good materials, however, are available that will impart this feature. You might be interested in learning that we periodically make a spot survey in the rubber field to help us decide on paths of research, and, in recent years, two items keep showing up: antiozonants and tackifiers.

The price range of available tackifiers is from 10¢ per pound to more than $2 per gallon. Natural and synthetic resinous materials are generally good tackifiers. In SBR rubber, tack is notoriously poor. Specially prepared cements make good tackifiers. Fatty acids such as stearic acid destroy tack. This point is also true for lubricants. These should be eliminated or reduced in the compound if tack is important.

Softeners and resins which in themselves are sticky will give some tack. This slight amount of tack, is most cases, is destroyed, however, by the addition of carbon black. Rosin acids in place of stearic will help to produce tack—the addition of natural rubber to SBR stocks will also help. Some of the best tackifiers are the coumarone-indene resins, hydrogenated rosin esters, polymers of styrene and substituted styrenes, polybutenes, metallic resinates, liquid polymers of specific elastomers, etc.

In conclusion, I must assure you that your needs and requirements for plasticizers and tackifiers are carefully being watched and studied by laboratories all over the country, and they are constantly on the alert making and testing new ones and improving old ones.

Questions and Answers

Q. Discuss tackifiers for carcass stocks, particularly in regard to their effect on the rate of cure, as well as on other properties. It is our understanding that most tackifiers used in carcass stocks tend to retard the cure. Would there be a demand for a non-retarding tackifier?

A. There are very few tackifiers from which to choose for this application. Ingredients that impart tacky, sticky characteristics are hard to find. Many compounders find that especially prepared cements are the best for carcass-stock use. When cements are used for this application, and retardation is noted, it can be controlled by a small addition of accelerator and/or a slight increase in sulfur.

Resinous materials, such as rosin and coal-tar products, do have some retarding properties because of their unsaturation and free acid. Unsaturation has a tendency to steal sulfur; however, the unsaturation can be reduced or eliminated by hydrogenation. The free-acid portion can be reduced or eliminated by chemical reaction.

Q. What materials can be used to lower the durometer of compounds (other than silicone) that are exposed to moving air at temperatures of 350-375° F?

A. These high-temperature requirements make the problem difficult. The normal plasticizers will not meet the requirement. There is an indication that a "silicone oil-treated filler" might impart the desired properties to the compound. One that I can think of is a treated precipitated hydrated silica.[21] This product acts as a plasticizer, and its incorporation, in place of the plasticizer, may enable you to approach the temperatures that are required.

[16]Hypalon, E. I. du Pont de Nemours & Co., Inc. trade mark.
[17]Aircraft Materiel Specification.
[18]Flexol 4GO, Carbide & Carbon Chemicals Co. trade mark.
[19]Paraplex G-25, Rohm & Haas Co. trade mark.
[20]Plasticizer SC, Harwick Standard Chemical Co. trade mark.
[21]Hi-Sil LM-3, Columbia Southern Chemical Corp. trade mark.

Reinforcing Agents

By R. A. Emmett

Columbian Carbon Co., New York, N. Y.

REINFORCING agents as referred to in rubber compounding parlance are pigments or powders which substantially strengthen vulcanized polymeric materials. They develop such properties as high tensile, abrasion, and tear resistance. This reinforcement is apparently due in large part to the physical effect of well-dispersed fine particle-size pigments. It also appears due to a condition of adhesion that develops between the rubber molecules and pigment particles which is probably a function of surface activity.

The dividing line between reinforcing agents and non-reinforcing fillers is not very great. Materials best known and most widely used today for their reinforcement properties are carbon blacks, silica and calcium silicate pigments, hard clay, and zinc oxide. Soft clays, whitings, barytes, and other ground minerals are generally considered in the non-reinforcing filler class.

Zinc oxide was undoubtedly the first material used in reinforcing rubber products. Used from the middle of the Nineteenth Century until shortly before World War I, it provided the basis for abrasion-resistant stocks and enjoyed wide application in such things as tire treads, soles and heels, and belting. Zinc oxide continues to be used, but to a limited degree in reinforcement of light-colored rubber products.

Silaceous pigments have moved into the picture since the 1940's and now enjoy large-volume usage for light-colored compounds. This popularity has developed because these pigments provide a higher order of strengthening to the polymer than zinc oxide and other light-colored pigments. They also give a generally lower level of cost on a volume basis than zinc oxide because of a much lower specific gravity. Fine particle size silicas develop properties of reinforcement which come the closest in matching those of carbon blacks. The best silicas develop approximately 70 to 80% the abrasion resistance of the best carbon blacks.

In 1912, carbon black was found to provide abrasion resistance and a versatility of reinforcement to rubber far in excess of anything obtainable with zinc oxide and any other pigments. Through the years carbon black has continued to be the Number One reinforcing pigment for the rubber industry, largely because of its high reinforcement over a wide range of loadings.

Carbon blacks are made from the incomplete combustion of natural gas, oil, or combinations of the two. Today's compounder has available 14 different types of carbons which fall into rather standard categories. In addition, he has perhaps a half dozen more for specialty applications.

These carbons vary in particle size, shape, and surface chemistry, thus making available to the compounder pigment properties suitable to assist in the designing of rubber products to meet specifications.

Carbon black production in 1912 was approximately 25 million pounds. Today's total world-wide production of all grades of carbon black is estimated at about two billion pounds. Of this total about 92% is used in rubber.

Carbon black has been referred to by a number of authors as the "King of Pigments." Through its use the abrasion resistance of tires of either natural or synthetic rubbers is increased manyfold. It can be conservatively estimated that approximately 400 billion out of the 500 billion miles of vehicular travel enjoyed by us annually are made on carbon black.

Questions and Answers

Q. Are there any new concepts on acceleration, or retarder-accelerator combinations that will provide greater scorch safety during processing of tread-type compounds using ISAF blacks?

A. Accelerators that we have found most suitable for obtaining maximum processing safety with ISAF carbons have been N-oxydiethylene benzothiazole-2-sulfenamide[5] and diisopropyl benzothiazole-2-sulfenamide.[3, 4] These have shown at least a 50% better scorch resistance than n-cyclohexyl-benzothiazole-2-sulfenamide.[7] Our findings indicate that the diisopropyl sulfenamide has a moderate advantage over the oxydiethylene sulfenamide.

Retarders such as n-nitroso diphenylamine,[22] salicylic acid,[23] and trichloromelamine and blanc fixe[24] are of assistance when used in conjunction with MBT or MBTS accelerators. They do not appear to be so necessary with the above delayed-action accelerators.

Q. Discuss the status of reinforcing agents other than carbon black for abrasion-resistant compounds including tires.

A. As mentioned, the silicas come the closest to matching carbon blacks in reinforcement. On abrasion resistance the best silicas come within 70 to 80% of the best carbon blacks. It has been shown that replacement of 10-20 phr of HAF carbon black in a tread formula with a silica does not adversely affect abrasion or tensile and improves hand tear. Such an approach has been suggested for use in off-the-road service tires.

[22]Vultrol, B. F. Goodrich Chemical Co. trade mark.
[23]Retarder W, Du Pont trade mark.
[24]TCM-25, Columbian Carbon Co.

CCDA Annual Meeting

The Commercial Chemical Development Association will hold its annual open meeting at the Hotel Statler, New York, N. Y., on March 28. "The Plastics Industry" will be the theme of the conclave. Talks, panel discussions, and the awarding of the CCDA annual citation for achievement in the commercial chemical development field will highlight the day's activities.

Sweitzer, Schoenfeld Speak at Two Ontario Meetings

"Carbon Black Surface Chemistry and Rubber Reinforcement" was the subject of a paper presented by Carl W. Sweitzer, Columbian Carbon Co., New York, N. Y., before more than 100 members and guests of the Ontario Rubber Section, CIC, at the Pickfair Restaurant, Toronto, Ont., Canada, on January 8.

The organization's December 11 meeting, held at the Collins Hotel, Dundas, Ont., was addressed by Frank Schoenfeld, vice president of research for The B. F. Goodrich Co., Brecksville, O., who discussed "Management Looks at the Next Ten Years."

Dr. Sweitzer said he took a position somewhere in the middle in the controversy between those who held that the reinforcing action of carbon black was a physical phenomenon and those who claimed it was chemical. Current investigations are coming to recognize that the surface chemistry of carbon blacks plays a role far beyond cure effects in rubber vulcanizates, Carl Sweitzer further declared.

The Columbian Carbon director of research and development pointed out that studies on the basic physical and chemical structure of the carbon black particle indicate the presence of functional groups attached to the edges of the individual graphitic planes in the crystallites, which in turn constitute the building blocks of the carbon particle.

These functional groups are composed of oxygen atoms linked to the surface through quinone or carbonyl linkages and hydroxyl groups. Infrared and polarographic studies are gradually revealing the type and the extent of these functional groups.

Evidence of this chemical interaction between carbon black and rubber is provided by recently reported studies on the behavior of carbon black as an inhibitor of rubber oxidation. The effect of carbon black in inhibiting gelation and scission reactions in polymers is further evidence of this chemical interaction.

According to Dr. Sweitzer, from the nature of the functional groups on the carbon particle surface, possible mechanisms for this interaction are postulated which include addition of free radicals to the carbon black surface as well as reaction of the surface groups with unaltered molecules. Confirmation of this surface group activity is provided by tests, in which the groups are removed or inactivated.

Dr. Schoenfeld, in his December 11 talk, predicted that the opening of new technical frontiers in the next ten years will produce a dynamic economic growth in both the United States and Canada. He especially anticipated new developments in farming, the synthetic fiber industry, plastics in prefabricated housing, chemotherapeutic agents for cancer and new tranquilizing drugs, atomic energy, industrial automation, synthetic rubber, and marketing.

At the January 8 meeting it was revealed that the group had voted for affiliation of the Ontario Rubber Section within the Rubber Division of the Chemical Institute of Canada.

Talks on New Polyethylenes at Northeastern Section

George E. Hulse, Spencer Chemical Co., spoke on "The Newer Polyethylenes" before 85 members and guests of the Elastomer & Plastics Group, Northeastern Section, ACS, at the New England Industrial Park office and warehouse of The Goodyear Tire & Rubber Co., Needham Heights, Mass., January 15.

After reviewing the development of the high pressure-high temperature polyethylene polymerization process, Dr. Hulse pointed out that with this polymer, structure has a much greater effect on properties than most polymers. By means of charts, he indicated how these properties could be related to weight average and number average molecular weights and to linearity.

Another chart comparing density and melt index figures of the old and new polymers served to illustrate the uses to which each type of polyethylene was customarily applied. The old was shown to be preferred for insulation and where toughness was important; while the newer was said to be preferred for molding and in applications where its gloss and crispness were desired.

Dr. Hulse predicted that one billion pounds of polyethylene would be sold in 1960, 700,000,000 pounds of which would be high-pressure material. These figures would represent a 150% increase for current film and coating consumption, a doubling of pipe production, tripling of electrical consumption, and five times the present bottle production.

The meeting was preceded by an inspection tour of the Goodyear facilities arranged by its manager, John M. Hussey, a former Group chairman.

Free Radicals Symposium

A symposium on "Formation and Stabilization of Free Radicals" will be held at the National Bureau of Standards, Washington, D. C., September 18-20, under the joint sponsorship of the applied physics laboratory of Johns Hopkins University, the Catholic University of America, and the NBS.

The conference is expected to provide a useful medium for exchange of information on the isolation and study of free radicals, a field in which interest has been stimulated recently by advances in low-temperature physics and high polymer research.

Further information may be obtained from Dr. A. M. Bass, Free Radicals Research Section, National Bureau of Standards, Washington 25, D. C.

Zapp Talks at Washington

Robert L. Zapp, Enjay Co., spoke on "The Nature of Butyl Rubber and Its Compounds" at the January 16 meeting of the Washington Rubber Group at Pepco Auditorium, Washington, D. C.

The versatility of butyl rubber has been demonstrated by the fact that experimental tires have been successfully fabricated from this material. Mr. Zapp declared. General factory procedures have been used that have produced tires capable of surviving 6,000 miles on a Bureau of Standards cleated wheel.

Greater comfort, lower noise level, lack of squeal on curves and stops, and a higher coefficient of friction with the road were qualities attributed to butyl tires which are not found in current SBR tires. Mr. Zapp said that the butyl tire's higher coefficient of friction allowed it to stop in 15 to 30% less distance for a given speed, a safety advantage observed on both wet and dry pavement. Tread wear of butyl tires is considered to be comparable to present commercial standards.

The Enjay researcher's talk was similar to the one he gave before The Los Angeles Rubber Group, Inc., October 2, reported in the November, 1956, issue of RUBBER WORLD (page 277).

Design Engineering Show

A Design Engineering Show will be held at the New York Coliseum, New York, N. Y., from May 20 to 23, in conjunction with a conference on innovations in the design engineering field, under the sponsorship of the machine design division of the American Society of Mechanical Engineers. About 20,000 are expected to attend the Show and conference.

The exposition has established itself as the showplace for the original equipment market, where products which go into the making of end products are demonstrated. Types of products to be shown include mechanical, electrical, hydraulic and pneumatic components; metallic and nonmetallic materials; fasteners; finishes and coatings; shapes and forms; and accessories to product development.

Advance registration cards and hotel information may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y., the exposition management.

Fort Wayne Meeting

The Fort Wayne Rubber & Plastics Group, meeting December 6 at the Van Orman Hotel, Fort Wayne, Ind., heard Jerome Kelble, of Wright Air Development Center, talk on "Aircraft Elastomer Problems Resulting from Exposure to Temperature Extremes." Slides illustrated the discussion.

The 244 members present also saw a film on recent developments in United States aircraft.

Post-dinner entertainment was provided by The General Tire & Rubber Co. Laboratory Quartet consisting of William Long, Jack Miller, George Berg, and DeVon Wilson.

1957 Goodyear Medalist Nominations

Members of the Division of Rubber Chemistry of the American Chemical Society are invited to propose names of nominees for the award of the Charles Goodyear Medal of the Division for consideration by the medal committee at the spring meeting of the Division, scheduled for Montreal, P. Q., Canada, May 15-17. Any member wishing to propose a candidate may obtain from A. M. Neal, secretary, Division of Rubber Chemistry, ACS, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., an outline suggesting the form in which such a proposal should be made. This form also appears on page v of the January-March, 1956, issue of *Rubber Chemistry and Technology*. The proposal in the proper form should be mailed to Dr. Neal prior to April 12.

The Charles Goodyear Medal Award of the Division of Rubber Chemistry was instituted in 1939 to commemorate the one-hundredth anniversary of the discovery of the vulcanization of rubber with sulfur. According to the by-laws of the Division, the Charles Goodyear Medal "may be awarded annually to a person who has made a valuable contribution to the science or technology of rubber or related subjects." The award is not restricted to persons residing in the United States.

Rubber Group Parties

Boston Affair

About 600 members of the Boston Rubber Group took part in its annual Christmas party at the Hotel Somerset, Boston, Mass., December 14. A post-dinner program of entertainment was arranged by the retiring chairman, James Williamson, Tyer Rubber Co.

The slate of newly elected officers who will serve during 1957 was announced. They are: chairman, Arthur I. Ross, American Biltrite Rubber Co.; vice chairman and chairman-elect, Roger L. Steller, B. F. Goodrich Chemical Co.; and secretary-treasurer, William H. King, Acushnet Process Co. James J. Breen, Barrett & Breen, Inc., was chosen to serve on the executive committee for two years, and George Herbert, Tyer Rubber, was selected to serve for one year.

Biggest Chicago Yule Fete

What has been called the largest and most successful Christmas Party and Ladies Night in the history of the Chicago Rubber Group was held at the Morrison Hotel, Chicago, Ill., December 21, with more than 1,020 members and guests in attendance.

A cocktail hour and roast beef dinner were followed by entertainment and dancing. A gift of a leather luggage case was given to each of the ladies present.

The committee in charge of arrangements consisted of John B. Porter, H. Muehlstein & Co., Inc., chairman; Jim Moore, Roth Rubber Co., vice chairman; and Richard Scholl, Arno Adhesives; Maurice O'Conner, O'Conner & Co.; Frank Smith, Williams-Bowman Rubber Co.; Stan Shaw, Witco Chemical Co.; Ted Argue, Roth Rubber; and John Swart, Van Cleef Bros. division of Johns-Manville.

SORG Festivities

The Southern Ohio Rubber Group held its tenth annual Christmas party at the Miami Valley Golf Club, Dayton, O., December 15, with 275 members and guests in attendance. Dinner and dancing made up the evening's activities. Everyone present received a door prize.

J. E. Feldman, Inland Mfg. Division, was chairman of the committee in charge of arrangements, and W. A. Smith, Precision Rubber Co., was associate chairman. Other committee members were H. Gillette, Precision Rubber; D. Strack, R. Waymire, and F. Ekberg, Inland Mfg.; R. Feldhaus, Toledo Amsco; G. Lang, Premier Rubber Co.; J. Shrontz, Harwick-Standard Chemical Co.; C. Wimmer, Phillips Chemical Co.; B. Adinoff, Dayton Rubber; and S. Pomeranz, Vernet Labs.

Quality Control Course

The tenth annual short course in "Quality Control by Statistical Methods" will be given by the University of Illinois at its College of Engineering, Urbana, Ill., March 11-21. Designed for those in the fields of design, production, procurement, management, quality control, and inspection, the course will stress control charts and acceptance sampling.

Further information may be obtained from John A. Henry, Mechanical Engineering Laboratory, University of Illinois, Urbana, Ill.

SPE Elects Officers

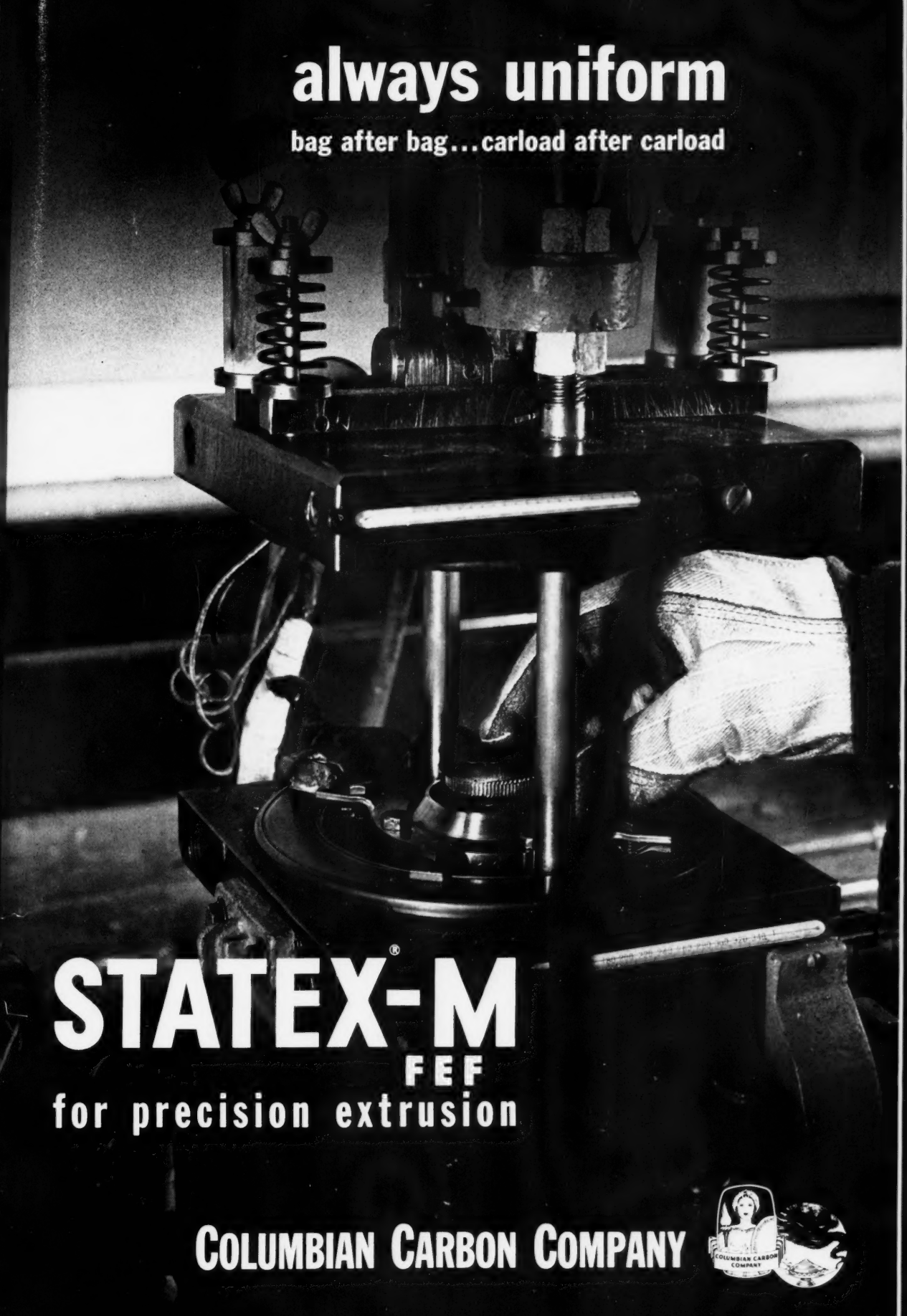
The Society of Plastics Engineers has elected Peter Simmons, Dow Chemical Co., president; Haiman Nathan, Atlas Plastics, vice president; R. K. Gossett, Gossett & Hill, secretary; and Jules W. Lindau, III, Southern Plastics and the University of South Carolina, treasurer.

Mr. Simmons announced the publishing of the organization's first sponsored technical book, "Quality Control for Plastics Engineers," edited by Lawrence M. Debing, Monsanto Chemical Co. A volume on "Processing of Thermoplastic Materials" is to be published later this year under the editorship of E. C. Bernhardt, E. I. du Pont de Nemours & Co., Inc.



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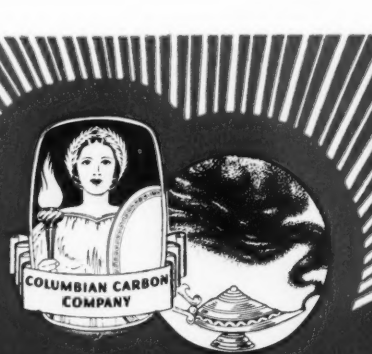
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NEWS of the MONTH

Washington Report and National News Summary

. . . The Commerce Department, Business & Defense Services Administration, Chemical & Rubber Division, has predicted that 1957 will be one of the biggest years in the history of the rubber industry, with special reference to both investment and sales volume.

. . . President Eisenhower's budget for the fiscal year 1958 includes an increase of $25 million for the National Science Foundation for basic research and training technical manpower. Additional funds for high polymer research should result.

. . . A bill for sale of the government's alcohol-butadiene plant in Louisville, Ky., without restriction as to the product manufactured and without a 10-year standby clause has been introduced in the new Congress.

. . . The General Services Administration has postponed its scheduled January meeting on natural rubber stockpile policy until March.

. . . John L. Collyer, chairman of the board of The B. F. Goodrich Co., has recommended that the government plan now for the reduction and eventual liquidation of the natural rubber stockpile in order to prevent a large loss to taxpayers.

. . . The United Rubber Workers of America, CIO-AFL, has charged the United States Rubber Co. with a breach of union contract in connection with the company's plans to close its Washington, Ind., plant. In another action URWA has called for a boycott of products of O'Sullivan Rubber Co., where a local URWA union has been on strike since May, 1956.

Washington Report

By ROBERT E. L. ADAMSON

Commerce Sees Sales and Investment Record in 1957 for Rubber; Similar Record for Chemicals Possible

The Commerce Department's rubber and chemical experts took their annual look into the crystal ball in January and came up with the prediction that 1957 will be one of the biggest years in history for the rubber industry, with special reference to both investment in the industry and sales. By the same token, chemical industry sales are expected to top 1956's record of $24.3 billion by almost 6%, and investment in "new plant and equipment" should be about $1.75 billion, a 19% increase over last year's expenditures.

Rubber Forecast

The forecast, prepared by the Chemical & Rubber Division of the Business & Defense Services Administration—the Division is headed by Monsanto's Hal G. Johnson—showed that 1956 was the second largest sales year in history for the rubber industry, although final figures were not yet available for the year. The following are the highlights of BDSA's "educated guess" on what 1957 will bring for the rubber industry.

SALES. With unit prices inching upward, a new sales record appears in the making, with the first quarter expected to be up about 7% over the last three months of 1956. The all-time high of $5.5 billion reached in 1955 was not equaled last year, but the previous 1953 high of $5.1 billion "was undoubtedly surpassed." Through the first nine months of 1956, sales were about $4.01 billion, but the fourth-quarter rate was up 6.5% over the third-quarter figure.

CAPITAL OUTLAYS. The rubber products industry spent a record $195 million on new plant and equipment in 1956, compared with $150 million in 1955 and $161 million in 1953, the previous high. For the first quarter of 1957, when the seasonal low normally occurs, spending is scheduled at $44 million, some $4 million higher than in the same period in 1956. Since a very good production year is anticipated, and large expenditures for plant and equipment have already been announced, "it appears likely that a new high for capital outlays, in excess of $200 million, will be established" this year.

PRODUCTION. The Federal Reserve Board index for first-quarter production is expected to reach 138 (1947-49—100) 3% above that for the last quarter of 1956, and the likelihood is good that the year will match or exceed the 1955 production peak of 143. For the last three months of 1956 the average ran about 134, some 8% less than output a year earlier, but still 4.7% higher than for the preceding three-month period. For the full year 1956, the index is expected to average about 133, 10 points below the 1955 peak year.

STOCKS. No material change in the value of inventories is anticipated in early 1957, with a slight uptrend chiefly reflecting increased raw material prices.

PRICES. The natural rubber spot price ranged between 26½ and 45¢ a pound in 1956, closing the year at 37⅜¢, and averaging 34.2¢, compared with 39.1¢ in 1955. The outlook is for a continued high world demand and not unlimited supplies, although Western European demand has recently slowed owing to slackened tire output occasioned by restricted gasoline supplies. Synthetic rubber prices are not expected to increase materially.

With no great reduction in raw mate-

rial costs on the horizon, and a general rising price trend, it appears that rubber products prices will show some increase in 1957, but no rapid rise is anticipated. The wholesale price index of rubber and rubber products (1947-49—100) was 146.9 in November, 1956, as against 151.0 in December, 1955, a decrease that reflected lower natural rubber prices. The index for tires and tubes in the same span increased to 153.4 from 151.8.

PROFITS. Net profits after taxes for rubber products manufacturers in the fourth quarter of 1956 are expected to show the pressures exerted by mounting costs, indicating a possible drop of 9% from last year's comparable level, although the downtrend will probably be reversed in the first quarter this year.

CONSUMPTION. New rubber consumption is expected to reach a level of about 1,510,000 long tons, some 1.3% short of the 1955 all-time high of 1,530,000 tons.

Chemical Forecast

BDSA also predicted another record-breaking year for the plastics industry, with output of plastics materials and resins expected to reach 4.2 billion pounds, about 5% above the estimated 1956 volume. These are the highlights of the Division's predictions for chemicals generally:

SALES. The 1956 figure is expected to close at $24.3 billion, a 5.5% increase over the sales volume for chemical products in 1955. This new record is expected to show that about eight months of 1956 exceeded the $2 billion mark, each. The current, short-term trend indicates a continuation of chemical sales on a fairly stable plateau for the first six months of 1957, probably resulting in a total of about $12.6 billion for the first half, followed by a moderate rise in the second half to $13.1 billion. Part of this total of $25.7 billion—a 5.8% increase over 1956 figures—will be attributable to rising prices resulting from increased costs.

CAPITAL OUTLAYS. Chemical manufacturers will probably spend $1.75 billion for new plant and equipment. The 1956 record of about $1.46 billion came in the face of restrictive credit conditions and little rapid tax write-off help from the government, indicating a high level of confidence in the future volume of business.

Although spending scheduled for the first quarter this year shows a normal seasonal decline ($409 million), it is expected to swing up in the second quarter and continue upward through December. The continuing tight-money situation is expected to have little retarding effect on chemical expansion this year, mainly because of the greater use of retained earnings for capital outlay purposes and the dictates of very severe competition in processing and products.

PRODUCTION. Demand for chemical products is expected to advance slowly, but firmly in both halves of 1957, with a production increase for the year close to 4% above the 1956 figure, or an average 181 (1947-49—100).

STOCKS. Since August last year the book value of inventories in the hands of chemical manufacturers has remained at equivalent of 1.7 months of current sales, as compared with 1.9 months in July and 1.8 months in June. The present relative stability of the stock-sales ratio indicates a matching pace between rising sales and the build-up of stocks necessary to service distribution channels without intermittent disruptions. The continued high volume of sales in 1957 will probably be accompanied by some moderate rise in inventories, but a substantial part of the increase will be due to rising prices of raw materials.

PRICES. The overall level for chemicals as a group is expected to move upward. The fact that the November price index stood at 108.2, as compared with 106.3 at the beginning of 1956, indicates the upward pressures already being exerted by mounting labor, raw material, transportation, and packaging costs, as well as increasing capital equipment and research charges.

RESEARCH. In this key area of research, the Division predicted 1957 would be the chemical industry's greatest year for two reasons—competition and greater participation in developing the peaceful atom.

"The government expects shortly to declassify and release the largest amount of atomic data heretofore made public," the forecast pointed out. "Many of these previously confidential papers are expected to deal with the application of nuclear energy and irradiation to industrial processes and products. Because of these new technical advances, which involve a large area of fundamental as well as applied research and for competitive reasons, it is anticipated that more funds will be expended on chemical research and development in 1957 than ever before, probably in the neighborhood of $475 million by the chemical industry alone.

"The expected surge in research, especially in the field of nuclear energy applications to industrial products and processes, will highlight very sharply the current and anticipated shortages of competent technical and professional personnel. If the United States is to maintain its dynamic growth and research leadership, industrial and educational authorities must stress all possible media to induce younger students to enter upon scientific careers."

President Ups NSF Budget $25 Million for Research; Bureau of Standards Gets $4.8 Million More Funds

President Eisenhower's $72 billion budget for the fiscal year beginning July 1—fiscal year 1958—contained a whopping increase of $25 million for the National Science Foundation, which spends a lot of money on synthetic rubber and other high polymer research. NSF, which is operating on a $40-million budget this fiscal year and which spent only $16 million last fiscal year, has thus quadrupled its expenditures over a two-year period.

Basic Research and Education

In his message explaining the fiscal 1958 budget to Congress, President Eisenhower said the latest boost of $25 million "will enable the Foundation to deal more effectively with two problems of national importance in the field of science.

"First, only a very small proportion of the billions of private and public funds devoted to research and development is for the basic research on which progress in the applied scientific fields of health, industrial technology, and weapons development depends. The Foundation will increase its grants for basic research projects and for special research facilities.

"Second, to help overcome the acute shortage of skilled scientists and engineers, the Foundation will make a major effort to improve training in science, particularly by increasing the number of qualified teachers, by interesting a larger number of able students to enter scientific careers, and by granting fellowships to graduate and post-doctoral students."

The extent of emphasis on these two programs of NSF is clear from the comparison of the new budget requests with the rate of spending during fiscal 1957 and fiscal 1956. Grants for support of research projects totaled $9.5 million in 1956, were almost doubled this year to $16.3 million, and were almost doubled again in the new request of $29.6 million. Grants for training of scientific manpower totaled $3.5 million in 1956, shot up to $14.5 million in 1957, and are estimated at $18.8 million for fiscal 1958.

Just as meteoric, although on a smaller scale, has been the rise in NSF spending for support of research facilities during the past two years and into fiscal 1958. As against only $0.5-million spent in this area in 1956, the Foundation is spending $5.8 million this fiscal year and wants $12 million to spend in fiscal 1958.

Through these programs, plus its continuing review of research and training and exchange of scientific information, NSF is fulfilling its responsibility for "developing and encouraging pursuit of a national policy for the promotion of basic research and education in the sciences and for recommending to the President policies for strengthening the nation's scientific effort."

High Polymer Research

Dr. Raymond J. Seeger, assistant director of mathematical, physical, and engineering sciences at the Foundation, said the agency was supporting basic high polymer research—rubber, plastics, and fabrics—at a level of about $725,000 annually in grants to research people. Furthermore, he said, the new budget would continue this work at at least as high a level and probably higher, under NSF's basic chemical research program.

"High polymer research," he explained, "is now getting emphasis in our overall chemistry program, and we expect to continue at least at the level where it is now and we will probably expand it—particularly in the engineering and physics areas, as well as in chemistry.

"My feeling is that next year we will be putting just as much emphasis on new high polymer programs, and continuing the current ones."

NSF took over the federal rubber research program two years ago from the Federal Facilities Corp. and has whittled down a $1 million annual contract program to a grants program costing about $725,000. Of this figure, $550,000 is disbursed to research interests who held contracts under the FFC program on synthetic rubber. Another $175,000 has been assigned to investigators not previously supported under the contracts system. In the transition, synthetic rubber research as such was dropped, and the emphasis was shifted to the problem of basic high polymer research.

The initial grants under this program were issued for two years and run from the Fall of 1956 to the Fall of 1958; some, however, cover a three-year period ending in the Fall of 1959. With this part of the program already paid for through and beyond the fiscal year ending June 30, 1958, the Foundation intends to expand high polymer activity with some of the increased chemical money it has requested in the new budget.

The $29.6 million request for project grants includes a 75% increase in the amount being spent this year under the chemical program. Some $300-400,000 of this increase may be available for high polymer research, according to NSF officials.

NBS and Stockpile Funds

Other budget items of interest were:

An increase of $2.8 million to strengthen the basic scientific programs of the National Bureau of Standards, with emphasis on basic research and on the development of authoritative standards of greater range and precision adequate to meet the expanding needs of present-day science and industry, and to provide for improved technical balance in the Bureau's scientific activities. The total request is $11.5 million, including $4.9 million for basic research, $2 million for applied research, and $2.4 million for development work.

Another $2 million is requested for a start on new laboratory facilities for the Bureau in a Washington suburb. This initial amount, if approved by Congress, will permit the Administration to acquire a site, complete the preliminary work on design, engineering, and architecture, and begin construction.

The President asked for $130 million for maintenance and growth of the national stockpile, which includes a huge inventory of natural rubber. Added to $115 million expected to be carried over from the current fiscal monies, the request would give the General Services Administration $245 million to buy more commodities and rotate existing holdings.

New Louisville Butadiene Plant Disposal Law Urged; Bill for Sale without Product Restriction Drawn

Congress took the first step in January toward the third attempt in less than a year to dispose of the alcohol-butadiene plant at Louisville, Kentucky. After two unsuccessful attempts, however—one to sell and the second to rent for a long-term, the government appears certain to sell the plant this year under these conditions: (1) no restriction on the commodity or commodities to be produced by the purchaser; (2) no requirement that the plant be returned to butadiene production if an emergency should develop within 10 years after sale; and (3) the buyer must bid at least $3.5 million, the "floor" price considered a minimum fair value by FFC.

Prompt Sales Law Asked

FFC filed its reasons for turning down two offers to rent last fall in a report to the House Armed Services Committee last month, and to the surprise of none, the failure of the lease negotiations was laid primarily to the strong indications that the government could do much better by selling. Furthermore, FFC Administrator Laurence B. Robbins urged Congress to pass authorizing sale legislation quickly and to require completion of the sale before the present session of Congress terminates this summer.

"The Corporation is convinced," he put it, "that the possibility of an attractive sale will be enhanced if prospective bidders can be assured in the legislation that the sale must be completed in the first session of the 85th Congress, since such timing would enable a successful bidder to complete engineering plans for utilization of the Louisville property upon its takeover in April, 1958, at the expiration of the [lease now held by Publicker Industries], and because companies which might wish to bid would know that they would not be delayed unduly in seeking other properties to fit their plans if their bids were unsuccessful."

This suggestion went unheeded in a sale authorization bill introduced by Rep. Carl Vinson, Georgia Democrat who heads the Armed Services Committee. The Vinson bill, however, can be amended to meet the Robbins' view on timing of the sale. Nevertheless, Vinson did word his bill to reflect two even more important Robbins' suggestions—no 10-year standby clause in any sale contract which might be concluded, and no restriction that the plant be used to produce butadiene.

Market Favorable

"It seemed logical," Robbins said in his report on the unsuccessful lease negotiations, "to believe that this advantageously located plant, accessible to water traffic, should bring a higher price than $3,500,000, with the removal of the restriction of use of the plant to the synthetic rubber industry [butadiene] and the accompanying modification of the National Security Clause [10-year standby] requirement, both of which had served to limit interest among prospective purchasers and to depress the price which could be obtained.

"An early sale, not a long-term lease which would tie up the plant for 10 to 15 years, thus appeared to serve better the government's overall interests, including specifically the greatest possible return on its investment in the property, and the Corporation has received various expressions of interest from non-bidders in the possible purchase of the plant upon a reoffering for sale in the near future under new legislation."

Robbins presented some interesting facts on production plans for butadiene—other than at Louisville—to support his advice that it could be released from the requirement that it be kept within the synthetic rubber industry. Reports to FFC, he said, show that national petroleum butadiene capacity, rated at 661,000 short tons at the end of 1955, would be increased by an additional 416,000 short tons during 1957 and early 1958. The total exceeds 1959 estimated annual requirements of butadiene for synthetic rubber and all other purposes by 146,164 short tons, he added.

Just how lively the Congressional hearings and debate on new disposal legislation might be is underscored by a quick reminder of the first two unsuccessful disposal efforts of the government. In the bidding for sale last spring, Union Carbide & Carbon Corp. outbid Publicker with an offer of $3.5 million, the figure now used by FFC as a "floor" for future bidding. Publicker subsequently matched this offer within what is considered the legal time limit for bidding, but was rejected. Later the proposed sale to UCC was blocked by the Vinson committee at the urging of Publicker. The same companies locked horns last fall when Louisville was offered for long-term rent, with Publicker again running behind UCC in the bidding, and both firms again losing out on acquisition of the plant.

Publicker Position

However, FFC says, it expects "several other" firms to enter the race, as well as Publicker and UCC, if Congress approves the Vinson bill making the plant available for general chemical production. Publicker, which feels strongly that Louisville should be available for the production of alcohol butadiene "at all times," will not go down without a fight. The company summed up its position in a memorandum to FFC during the lease negotiations:

"Admittedly . . . the future national requirements for butadiene for synthetic rubber and other essential uses are difficult to predict precisely. Expansions of petroleum butadiene capacity are under way—but so are expansions of synthetic rubber polymerizing capacity and also certain chemical demands for butadiene in quite different fields.

"We think it pertinent to point out also that the emergency value of the Louisville plant cannot be weighed solely by comparing total available petroleum butadiene capacity, present and planned, with total estimated synthetic rubber and chemical requirements. The critical point is the large proportion of butadiene capacity, both present and future, that depends and will continue to depend on butylene.

"It is thus competitive with high-octane gasoline for which the total potential military demand, which is considerably larger than the demand for aviation gasoline alone, is not only large, but absolutely indispensable.

"The vital fact—other than Congres-

sional policy to keep this plant as an alcohol butadiene producer—is that from 1942 to the present day, alcohol butadiene has always been said by certain important industrial interests to be unnecessary, but in every rubber crisis it has always been required. Congress has clearly taken the position that the chances of alcohol butadiene being required again are great enough, and its importance when required is sufficiently urgent, that the Louisville plant must remain available for this purpose."

Union Carbide Position

Although UCC, in revealing its plans for production at Louisville to FFC, did not promise to restrict output to butadiene, it did not rule out the possibility of producing butadiene and even went so far as to assure the government that it would make the appropriate moves to guarantee adequate supplies of ethyl alcohol, the raw material for alcohol butadiene. This is the way it summed up its plans if successful in taking over Louisville:

"Carbide intends to produce butadiene and/or miscellaneous other chemical products at the facility. Carbide will determine which products it will produce after consideration of conditions prevailing when Carbide obtains possession of the facility.

"Ethyl alcohol and other basic raw material required to operate the facility for the production of butadiene and/or miscellaneous other chemical products, will be available from several sources, including facilities operated by Carbide. Appropriate arrangements for a supply of ethyl alcohol and other basic raw materials are being made.

"It is expected that substantially all of the products produced at the facility will be available for sale and will be sold on Carbide's standard terms and conditions of sale for similar products which it produces at other facilities. When butadiene is produced by Carbide at the facility, it is expected that the production will be offered for sale on the open market at prices, to all consumers, competitive with prices for other butadiene produced from alcohol. Carbide is willing to specify, if the FFC so requires, that the butadiene produced at the facility will be available for sale, at such prices, to producers of GR-S synthetic rubber on reasonable terms and conditions substantially similar to Carbide's standard terms and conditions of sale of similar products."

Quick Disposal Desired

In the end, price and not product will probably determine the fate of new disposal legislation. Vinson, his aides on the Armed Services Committee, and FFC make no bones about the fact that they are unhappy with (1) the $342,000 annual maintenance and tax bill paid by the government under the existing lease, and (2) limited operation of the plant during the first two years of the Publicker lease which expires in April, 1958.

"The history of Publicker's Louisville operation," FFC pointed out in its report on the lease talks, "lent no encouragement to its request for a continuation of the lease for 10 years beyond 1958 on the basis of rentals dependent upon production.

"Publicker took possession as lessee at Louisville on April 4, 1955, and commenced production of butadiene on one of the three production lines in October, 1955. It ceased operations completely on October 3, 1956, had no substantial production after August, 1956, and actually manufactured a total of 21,839.99 short tons of butadiene while it operated.

"Through September 30, 1956, the government received in rental $137,702.45 and paid out over the period April 4, 1955, through September 30, 1956, approximately $377,168.07 for maintenance and taxes.

"Publicker stated that although it expected the molasses supply situation to change materially for the better by 1958 it foresaw no likelihood of any operation in 1957, so that the government must expect to assume the entire burden of maintaining the plant and paying the taxes thereon during such period, with assured income limited solely to the guaranteed monthly rental of $1,000."

GSA Meeting on Stockpile Postponed until March

The General Services Administration in January called off a meeting of its 18-man Rubber Industry Advisory Committee tentatively scheduled for late in the month to review the natural rubber supply situation and the need of a special government program to augment supplies delayed by the closing of the Suez Canal.

In the light of the hassle over the program, as proposed by The Rubber Manufacturers Association, Inc., and shelved by the Office of Defense Mobilization in December, GSA was cautious in explaining its reasons for cancelling the meeting. It appeared likely, however, that the decision was made in the light of healthy supplies of natural which developed after Christmas as free Europe cut back its requirements and dealers here encountered no difficulties in getting shipments from the Far East.

The meeting was still scheduled when ODM Chief Arthur S. Flemming decided against immediate implementation of the RMA proposal in December, but GSA decided early in January that there was "no apparent reason" to hold it as tentatively scheduled. As a result, the meeting has been postponed until late this month or, more likely, some time in March at the soonest.

"Conditions are such," a GSA spokesman told RUBBER WORLD, "that there is no apparent reason that would warrant an immediate meeting of the committee [in January]. . . . The industry itself has not suggested a meeting. . . .

"Last fall we had contemplated—in view of the conditions then—that a meeting would be held in January, and we had tentatively scheduled one. As we approached January, the need of a meeting diminished, and now we believe a meeting may take place in March, possibly a little earlier."

RMA had proposed that GSA authorize a change in the rotation of stockpiled rubber owned by the government if the shutdown at Suez brought a sharply tightened supply situation in this country because of vessel delays in taking the longer route via South Africa. Under the plan GSA would have rotated more rubber and authorized longer periods of replacement by commercial purchasers of government rubber.

Tire Excise Tax Payment Method Remains Unchanged

RMA walked off in January with a surprising victory over the National Tire Dealers & Retreaders Association to culminate their lengthy fight over a proposed change in the Federal Government's procedure for collecting excise taxes on tires and tubes. The tax has been collected for years when tires and tubes are sold by the manufacturer. In the case of company-owned stores, the tax is not forwarded to the Internal Revenue Bureau until it has been collected from the retail consumer; in the case of independent tire dealers, the tax is collected when the independents are billed for the merchandise, but they, in turn, do not recover this capital until they collect from the retail consumer.

1956 Forand Bill

This situation had all the earmarks of an unfair competitive advantage as between company-owned and independent dealers, and the Forand subcommittee of the House Ways & Means Committee, headed by Rhode Island Democrat Aime J. Forand, decided last year to recommend a change in the law to provide equity. The subgroup suggested collection of the tax at the time tires and tubes were withdrawn from the factory for any purpose other than transfer to a warehouse within 20 miles of the factory. This suggestion was later incorporated in a bill introduced by Forand, but the bill died last summer.

Hearings Change Attitude

The subcommittee then scheduled interim hearings during the adjournment period, and it was during the course of these hearings that RMA presented testimony which swung the subcommittee back to the status quo. In short, RMA's Anson G. P. Segur told the tax unit that despite the seeming inequity, in actual practice most tires and tubes purchased by independent dealers were sold to their customers before they actually paid for the merchandise on an average of 45 days later. Thus, he claimed, the manufacturers were bearing most of the tax burden, since they paid the excises before collecting from the dealers.

This testimony, combined with complaints from both Segur and NTDRA's W. W. Marsh that the language in the Forand bill was a little too restrictive for both sides, eventually led to complete abandonment of the subcommittee's decision to recommend a change to its parent Ways & Means Committee. Furthermore, the subcommittee's report to the full committee noted that only three tire manufac-

turers operate their own stores and that tires and tubes moving through these outlets represent only a small fraction of total volume handled by the industry.

Forand Report

The report found that the discrimination alleged by the independents was not "as serious as indicated."

"Other testimony in the hearings stated that considerable time usually elapses between the date that the independent tire dealer receives tires from the manufacturer and the date that he pays for them. As a result, in many instances the independent dealer has sold the tires before paying either the tax or the merchandise price to the manufacturer.

"Other testimony before the subcommittee has shown that the provision in the bill would be injurious to the smaller tire manufacturers who do not have manufacturing plants located throughout the country and who must therefore rely on warehouses more than 20 miles from their manufacturing plants in order to provide national distribution of their tires.

"In view of the foregoing, your subcommittee does not believe that there should be a departure from the traditional concept of imposing the tire tax at the time of the sale by the manufacturer."

Bills on Alcohol-Butadiene, Footwear Tariff Shelved

Two legislative proposals of particular interest to the rubber industry were introduced shortly after the 85th Congress convened early in January. Both were introduced in the last Congress, and both were shelved:

1. Senators Roman L. Hruska and Carl T. Curtis, both Republicans representing Nebraska, offered a bill to transfer the government-owned alcohol plant at Omaha from the General Services Administration to the Department of Agriculture. Under their proposal Agriculture Secretary Ezra Taft Benson would institute a research program (a) for the manufacture of alcohol from surplus grains owned by the government, (b) for the use of this alcohol for the manufacture of synthetic rubber and other materials, and (c) for conducting research into new and improved uses of grains for industrial uses.

The Agriculture Department is also a strong bidder for the former rubber research laboratory-pilot plant at Akron, O., in conjunction with its program to find new uses for all farm products.

2. Rep. Antoni N. Sadlak, Connecticut Republican, renewed his ill-fated attempt of last year to close a loophole in the tariff barrier against heavy importations of cheap rubber-soled footwear. Foreign competitors, by producing the footwear with leather tongues or inserting leather somewhere else in the shoe-top, have been able to export their footwear to the United States under the lower duties applied to leather goods. The Sadlak bill would impose the higher rubber footwear duties on any rubber-soled footwear, regardless of the non-rubber content of the tops.

Johnson New BDSA Chemical Rubber Bureau Head



Hal G. Johnson

The appointment of Hal G. Johnson, director of general development, research and engineering division, Monsanto Chemical Co., as director of the Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce, was announced in mid-January by the administrator of the Business & Defense Services Administration, H. B. McCoy.

Dr. Johnson is on loan from Monsanto and will serve without compensation from the government for a period of six months or until July 1, under the rotation system currently in effect in BDSA. He is author of a number of patents, including some penicillin process improvements, and during World War II he took part in the development of glycol for aircraft and other vehicle uses.

The new Chemical & Rubber Division head is a member of the American Chemical Society, American Association for the Advancement of Science, American Institute of Chemists, American Institute of Chemical Engineers, Chemical Society (British), Commercial Chemical Development Association, and the Chemists Club of New York.

National News

Collyer Urges Government Plan Now for Reduction and Eventual Liquidation of Natural Stockpile

It is no longer a question of "whether" the Federal Government's stockpile of natural rubber should be liquidated, but rather a question of "when" and "how," according to John L. Collyer, chairman of the board, The B. F. Goodrich Co. In the sixteenth of a series of studies on rubber, dated November, 1956, and released in December, entitled, "National Security in Rubber," Collyer recommended that the government "plan now in order to prevent a large loss to taxpayers" when the present vast stockpile of natural rubber is liquidated.

In this recommendation the government was urged to relieve taxpayers of the heavy costs of storage of the rubber by (1) immediate disposal of excess quantities, and (2) planning for eventual complete liquidation of the stockpile.

He also urged, however, that liquidation be handled carefully to avoid serious injury to the domestic producers of synthetic rubbers and to foreign producers of natural rubber.

The Goodrich board chairman said he based his views on the fact that American private industry and Free World facilities are rapidly expanding capacities of plants for producing synthetic rubbers that are equal, and in some uses superior, to natural rubber.

Total Supply Demand to 1960

Table 1 was presented first to show the total world demand and the demand for synthetic rubbers through 1960 in view of the static supply of natural rubber until that time.

TABLE 1. ESTIMATED WORLD NEW RUBBER DEMAND* AND NATURAL RUBBER SUPPLY

(Thousands of Long Tons)

Year	New Rubber Demand*	Potential New Rubber Supply	Synthetic Rubber Demand†
1955‡	2,998	1,913	1,085
1956	3,070	1,900	1,170
1957	3,070	1,850	1,220
1958	3,240	1,850	1,390
1959	3,410	1,850	1,560
1960	3,590	1,850	1,740

* Except synthetic rubber demand from Iron Curtain countries.

† Based on difference between assumed annual supply of 1,850,000 long tons of natural and total new rubber demand for 1957-60.

‡ Actual.

Synthetic Supply-Demand

Expansion plans of the private synthetic rubber industry in the United States were next added to capacities of these plants in 1955 to provide an estimate of synthetic rubber capacity for the years 1957 and 1958.

As of July 1, 1956, synthetic rubber (including oil in oil-extended rubbers) production capacity in this country on an annual basis was 1,285,000 long tons, it was said. Expansion plans already announced should increase the capacity to 1,355,000 tons by January 1, 1957, and to 1,645,000 long tons by the beginning of the coming year.

Additional capacity to produce synthetic rubber or new capacity is being considered in Canada, France, Italy, Japan, West Germany, and in the United Kingdom, it was pointed out also. Present capacities total 125,000 long tons, and expansion plans already announced should increase the capacity to 270,000 tons or more some time in 1958.

A comparison of the demand for synthetic rubbers with the capacities estimated to be available indicates that there will be ample supplies available through 1958 and perhaps also through 1959 and 1960, it was added. The following table summarizes these figures.

TABLE 2. COMPARISON OF WORLD SYNTHETIC RUBBER DEMAND AND SUPPLY*

(Thousands of Long Tons)

		Available Capacities		
Year	Demand†	Total	USA	Rest of Free World
1955	‡1,085	§1,085	970	¶115
1956	1,170	1,350	1,220	130
1957	1,220	1,685	1,525	160
1958	1,390	1,925	1,675	250
1959	1,560			
1960	1,740			

* Excluding demand and supply in Iron Curtain countries.
† From Table I.
‡ Actual demand.
§ Actual supply.
¶ Actual production.

Reference was also made to synthetic polyisoprene as a complete equivalent to natural rubber to emphasize the fact that the United States need no longer be dependent upon foreign sources for natural rubber either in peacetime or in war. Goodrich has a pilot plant in operation for the production of its synthetic polyisoprene and says that large-scale production facilities can be built and brought into production in 18 months or less. Ample supplies of the required raw material are available in the United States.

Natural Stockpile Too Large

It was explained that the natural rubber stockpile now exceeds 1,200,000 long tons, and with private stocks around 100,000 long tons we have a total of more than 1,300,000 long tons. This amount is twice the quantity of natural rubber consumed in this country in 1955, and the Goodrich board chairman said that it was the opinion of his company that 900,000 long tons would be more than ample for a war of five years' duration.

Pointing to the cost of the vast stockpile, estimated at $825 million or more, Collyer said taxpayers can recover this cost only if the rubber is sold above cost. He estimated maintenance of the stockpile costs taxpayers about $38 million annually, excluding interest on investment, and probably totals $290 million since the stockpile was started.

Robins Predicts $2.5 Billion 1957 Non-Tire Product Sales

Thomas Robins, Jr., president, Hewitt-Robins, Inc., predicted sales of non-tire rubber products in 1957 in the neighborhood of $2.5 billion dollars, or about 54% of the rubber industry's total sales.

The non-tire segment of the industry is growing at a faster rate than tires despite the fact that more automobiles and trucks are on the road than ever before. This situation is due to the development of new products and increased usage of standard products, Robins said.

Demand is expected to continue strong for conveyor belting, industrial hose, foam rubber, footwear, rubber floor coverings, and other non-tire items.

The non-tire rubber companies are expected to consume about 570,000 tons of rubber in 1957, about 38% of the country's total rubber consumption. Non-tire products as a group contain less rubber than tires, but they contain more textiles and other materials that add to production costs.

Because production facilities for these products have been expanded to a point where supplies of most products are approximately in balance with demand, a highly competitive market is expected to continue throughout the year.

United States Rubber Co. Closes Plant; URWA, CIO-AFL, Claims Contract Breach

United States Rubber Co. announced on January 11 that it was closing its plant in Washington, Ind., following a series of incidents involving the company and the local and international United Rubber Workers of America, CIO-AFL, unions.

In November the company told employes at the plant that it would have to be closed because it was operating at a competitive disadvantage. This plant makes raincoats and other light rubber products, and the majority of its approximately 500 employes are women. According to URWA, the average straight-time rate per hour for women employes is $1.77, and $1.89 for the men. The local URWA union voted in December to accept a 25¢-an-hour cut in pay, and the company agreed to continue to operate the Washington plant.

The international URWA union president then charged the company with violation of the union's contract agreement concerning reopening wages for negotiation. U. S. Rubber then announced that it was closing the Washington, Ind., plant because "the international union and its policy committee are pressing the accusation that the company will be in violation of its company-wide union agreement if the wage cut is put into effect."

The international URWA union's policy committee reviewed the matter on January 5, but did not take action to file any legal proceedings for breach of contract or to process a grievance through arbitration to compel restoration of the wage cut.

URWA Boycotts O'Sullivan Rubber Co. Products

The United Rubber Workers of America, CIO-AFL, has called for a boycott of products made by O'Sullivan Rubber Co., charging that the company has failed to bargain in good faith with the local union at Winchester, Va.

URWA Local 511 has been on strike against O'Sullivan Rubber since May, 1956. The union had won a National Labor Relations Board bargaining election, but last May failed to reach an agreement with the company on a new contract.

L. S. Buckmaster, international URWA union president, said the boycott was the first in the 21-year history of the union, and that the action was taken only after every possible attempt by the union to settle the strike had failed. The union urged arbitration and mediation to end the dispute, but the company refused, he charged.

The international URWA union headquarters has asked its affiliated local unions throughout the country to set up O'Sullivan boycott committees and is also asking other CIO-AFL unions to aid in boycotting the company's products.

Flooring Design Contest Announced by RMA

The rubber flooring division of The Rubber Manufacturers Association, Inc., New York, N. Y., has announced a Rubber Floor Design Awards competition to be sponsored by its eight member companies and another manufacturer of rubber flooring.

The creator of the best-designed rubber floor installed in an institutional or commercial-type building in the period from January 1, 1957, through December 31, 1957, will receive a $1,500 award, with $500 going to the flooring contractor who has installed it. Six Honorable Mention citations will also be given.

The eight member-sponsors are American Biltrite Rubber Co., Inc., Trenton, N. J.; Danbury Rubber Co., Inc., Danbury, Conn.; B. F. Goodrich Flooring Co., Watertown, Mass.; The Goodyear Tire & Rubber Co., Akron, O.; Hewitt-Robins, Inc., Fremont, O.; Kentile, Inc., Brooklyn, N. Y.; Kleistone Rubber Co., Inc., Warren, R. I.; and also The R.C.A. Rubber Co., Akron.

The non-member sponsor is American Rubber Corp., Albertville, Ala.

Entry data sheets may be obtained from Rubber Floor Design Awards Committee, Rubber Flooring Division, The Rubber Manufacturers Association, Inc., 444 Madison Ave., New York 22, N. Y.

Other Industry News

Lee Jackson Steps Down as President of Firestone

Lee R. Jackson has been relieved of his duties as president of The Firestone Tire & Rubber Co., Akron, O., and has been elected to the newly created position of vice chairman of the board.

Harvey S. Firestone, Jr., chairman and chief executive officer of the company, said that Mr. Jackson had requested the change. Mr. Jackson has been associated with Firestone for 44 years. He was elected a director of the firm in 1928 and has served as president since 1948.

Raymond C. Firestone, who joined the company in 1933 and has served since 1952 as vice president in charge of research and development, has been elected president to succeed Mr. Jackson.

Mr. Firestone also announced the following additional executive changes: John J. Shea, to vice president and chairman of the finance committee; Harvey H. Hollinger, to vice president in charge of finance; succeeding Mr. Shea; Elton H. Schulenberg, to the office of treasurer, succeeding Mr. Hollinger; John J. Cohill, former assistant to the president, to vice president in charge of domestic subsidiary companies.

Joseph Thomas was reelected secretary and general counsel, and Claude A. Pauley was reelected to the office of comptroller.



Raymond C. Firestone

All other officers of the company were reelected.

The announcements were made following the company's annual stockholders meeting on January 19.

PCI Building 30,000-Ton Lake Charles Butyl Plant

A butyl rubber plant that will increase United States productive capacity of the rubber by one-third will be built by Petroleum Chemicals, Inc., at Lake Charles, La., adjoining its firm's petrochemical facilities.

In making the announcement, Bruce K. Brown, president of the company, said that an initial plant capacity of 30,000 tons a year will be installed at an investment cost of more than $17,000,000, and that the capacity would be expanded by 50% at a later date, some time before January, 1959.

Petroleum Chemicals, jointly owned by Cities Service and Continental Oil companies, has acquired a license from Standard Oil Co. of New Jersey, original developer of butyl rubber, covering patents and production techniques. Raw materials will be drawn from the hydrocarbon streams available at the Lake Charles refineries of Cities Service and Continental Oil. The new butyl plant will be the first built since World War II.

During the war Standard Oil built and operated two butyl plants for the government and later bought them. Initially used for automobile tire inner tubes, butyl rubber has recently found other industrial and commercial applications, including an all-butyl automobile tire announced last year by Enjay Co., the butyl rubber-producing affiliate of Standard Oil.

U. S. Rubber Sells Kaiser Its Wire and Cable Plant

United States Rubber Co., New York, N. Y., has sold its wire and cable business to Kaiser Aluminum & Chemical Corp., Oakland, Calif. The sale, which was for an undisclosed amount of cash, includes U. S. Rubber's Bristol, R. I., wire and cable plant, product inventories, sales organization, and distribution network.

According to H. E. Humphreys, Jr., U. S. Rubber chairman, his company had for some time been considering leaving the wire and cable business, since it was more closely allied to the metals field than to the rubber industry. U. S. Rubber expects to continue to supply the rubber used for wire insulation at the Bristol plant, where the company began operations in 1892.

The plant is located on an 18-acre site, about 15 miles south of Providence, R. I. It includes several buildings totaling 654,000 square feet of floor space. It is said to be equipped to produce a wider variety of wire products in both aluminum and copper than any other single plant in the country.

Products include building wire, service entrance cable, control cables, welding cables, low- and high-voltage power cables, flexible and portable cables and cords, signal cables, telephone and telegraph wires, and specially developed cables for the building, communications, public utility, electrical manufacturing, railroad, aircraft, electronic, marine, machinery, and tool industries.

Doubling Morpholine Output

Carbide & Carbon Chemicals Co., New York, N. Y., will double its morpholine-producing facilities at its South Charleston, W. Va., plant. The company was the first to make morpholine commercially and is its largest producer.

Morpholine is a raw material for the manufacture of several common rubber accelerators which permit low sulfur curing and reduce scorch. It is made from diethanolamine, which is derived from ethylene oxide. Carbide & Carbon recently completed expansions of its facilities for producing ethanolamines and ethylene oxide. The demand for morpholine is growing, the company says.

Neville Building New Lab

Neville Chemical Co., Pittsburgh, Pa., producer of resins and other coal and petroleum by-products, will build a $600,000 research laboratory on its 50-acre Neville Island tract and increase its research staff by 50% upon the completion of the structure in late summer.

The two-story brick building will contain 31,000 square feet of floor space and will be completely air-conditioned. Research for new products and chemicals will be done with the same basic materials the company has used in the past, according to Lee V. Dauler, president.

The company, founded in 1925, supplies hydrocarbon resins, solvents, and plasticizers to the rubber, floor tile, adhesives, varnish, and other industries.

Pantasote Sales Up

Pantasote Co., Passaic, N. J., manufacturer of coated fabrics and vinyl film, has shown a 6% sales increase in 1956 as compared to 1955 figures, according to a year-end statement. The firm also reveals that the new polyvinyl chloride plant of Eleonora Chemical Co., Passaic, a division of Pantasote, is now operating at full capacity.

Biggest Ton/Mile Conveyor Made by Hewitt-Robins

What is called the largest conveyor system ever built in terms of ton-miles per hour capacity has been designed, manufactured, and installed by Hewitt-Robins, Inc., Stamford, Conn., at Great Salt Lake, Utah, to carry 30-million tons of gravel fill for construction of a 13-mile roadbed for the Southern Pacific Railway.

The system consists of two main cross-country conveyor units plus eleven smaller conveyors linked together to provide continuous flow of gravel from a mountain to the lake two miles away. The new roadbed across the lake will replace a trestle mounted on wooden piles which has carried rail traffic over the lake for the last 52 years.

The belts on the main conveyors are 54 inches wide and travel at 850 feet a minute, which Hewitt-Robins says is twice the normal speed for conveyor belts. The belts will handle an average of 4,200 tons of gravel an hour, a new speed record for overland conveyor haulage.

To prevent excessive belt wear at these speeds, accelerating conveyors 30 feet long and 60 inches wide are used at the loading hoppers and at transfer points on the main line where one conveyor unit transfers to another. These accelerator belts move the material at a momentum of 500 feet a minute, thus easing the transfer to the main belts which are running at a rate of 850 feet a minute.

The conveyor system was designed by the Robins Engineers Division of Hewitt-Robins, New York, N. Y. The belting, totaling about 23,000 feet in length, was made by the firm's Hewitt Rubber Division, Buffalo, N. Y. The belts ride on 4,700 idlers produced by the Robins Conveyors Division, Passaic, N. J.

Sealdbins Rolling Army Fuel

United States Rubber Co.'s Sealdbins, collapsible fabric-reinforced rubber cylinders, are being used experimentally by the Army Transportation Corps to move bulk fluids, such as water, oil, or gasoline over difficult Arctic terrain. Sealdbins have been utilized in this country for the transportation of such bulk materials as carbon black.

In the Transportation Corps application, each Sealdbin is centered on axles, which are connected to a towing yoke. Several of the containers are linked together in a file, and the series towed by vehicles such as tracked movers.

Each cylinder has a capacity of 500 gallons of fuel. Six of the Sealdbins can be towed by a conventional Army jeep. U. S. Rubber, which worked with the Transportation Corps in developing the Sealdbin application, has dubbed the system Rolling Fluid Transporter.

Plastics Output, Sales at Record Levels in 1956

Production of plastics and synthetic resin materials in the United States during 1956 reached a record 4,112,900,000 pounds, according to an estimate of the Society of the Plastics Industry, Inc., New York, N. Y. The figure, an increase of 10% over 1955 output, represents the first time the industry has gone over the four-billion-pound mark.

The value of the industry's products came to about $2,056,450,000 in 1956, the SPI estimates, another record total and the first time the industry has risen over the two-billion-dollar mark. In 1955 the industry made products valued at $1,869,458,000.

Looking to the end of 1957, the SPI says that the capacity of the industry, which operated at its top level during 1956, will be increased 5% this year, with about a 5% increase in production, or 4,300,000,000 pounds.

Estimated 1956 production of certain major plastics follows: polyethylene, 541,128,000 pounds, up 30%; polyesters, 71,800,000 pounds, up 30%; vinyls, 729,500,000, up 10%; styrenes, 636,000,000 pounds, up 4%; phenolics and other tar acid resins, 503,000,000, no change; ureas and melamines, 312,000,000 pounds, no change; and cellulosics, 140,000,000 pounds, down about 10%.

Manhattan Rubber Shuffles

The field sales structure of Manhattan Rubber & Packing Division has been reorganized into four geographical sales regions by Raybestos-Manhattan, Inc., Passaic, N. J., the parent company. They are the eastern, central, southern, and western sales regions.

R. F. Teeling has been named eastern regional manager, with Stewart Monroe, New York district manager; J. T. M. Frey, New Jersey district manager; and F. McBrearity, Philadelphia district manager.

A. L. Hawk has been appointed central regional manager, with A. N. Johnston, Jr., Pittsburgh district manager; G. S. Himebaugh, Chicago district manager; and E. T. Fair, Denver district manager.

C. P. Shook, Jr., becomes southern regional manager, with A. A. Ringland, Birmingham district manager; A. E. Jackson, New Orleans district manager; E. W. Nagel, Dallas district manager; and R. C. Nielson, Houston district manager.

S. V. V. Hoffman has moved to western regional manager, with R. B. Park, San Francisco district manager.

Du Pont Education Grant

A 1958 fund of more than one million dollars for grants to 122 universities and colleges in its annual program of aid to education has been announced by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

More than half of the total grant is for the improvement of teaching in universities, colleges, and high schools. The grants will support science and mathematics, as well as other subjects. Du Pont's 1957 grant was more than $900,000.

Acquires Plastic Molder

American Hard Rubber Co., New York, N. Y., has acquired Electric Mfg. Co., Inc., San Francisco, Calif., manufacturer of multi-color plastic moldings for industry, such as telephone dials, key buttons for business machines, etc. Electric's principal officers will continue in their present capacities.

According to V. T. Norton, president of American Hard Rubber, the acquisition represents another step in his company's continuing plans for expanding and diversifying its business.

Ore Conveyor System

A new system of 25 shuttle belt conveyors, the first of its kind ever used to load Great Lakes ore vessels, will load taconite pellets at Erie Mining Co.'s Taconite Harbor, Minn., port facility on Lake Superior when it begins operations.

Designed and built by Link-Belt Co., Chicago, Ill., the belt conveyor system will permit the loading of as many as 10 alternate hatches simultaneously, a departure from the conventional method of loading ore vessels by chutes.

According to Link-Belt, two vessels will be loaded simultaneously, and the complete system of shuttle belts for each vessel will be operated from a central control tower. Each of the 25 shuttle belt conveyors on the 1,200-foot-long dock will be capable of loading taconite pellets at the rate of 750 or 1,500 long tons per hour at belt speeds of 250 or 500 feet per minute.

Phillips Licenses in Brazil

Phillips Petroleum Co., Bartlesville, Okla., has licensed Industrial Quimicas Eletro Cloro, S. A., Brazilian subsidiary of Solvay & Cie., to use in Brazil the Phillips-developed catalytic process for making rigid polyethylene. Solvay & Cie., Brussels, Belgium, had previously been granted exclusive rights to use the process in Italy.

Phillips also announced it was starting operation of the first unit of its 110-million-pound-a-year polyethylene plant at its Adams Terminal chemical manufacturing site on the Houston Ship Channel.

Mobay, Bayer Swap Men

Ray E. Bolin, Jr., a research chemist in the technical service department of Mobay Chemical Co., St. Louis, Mo., is in Leverkusen, Germany, for a six-month study of urethane foam technology at the plant laboratories of Farbenfabriken-Bayer, co-owner with Monsanto Chemical Co. of Mobay.

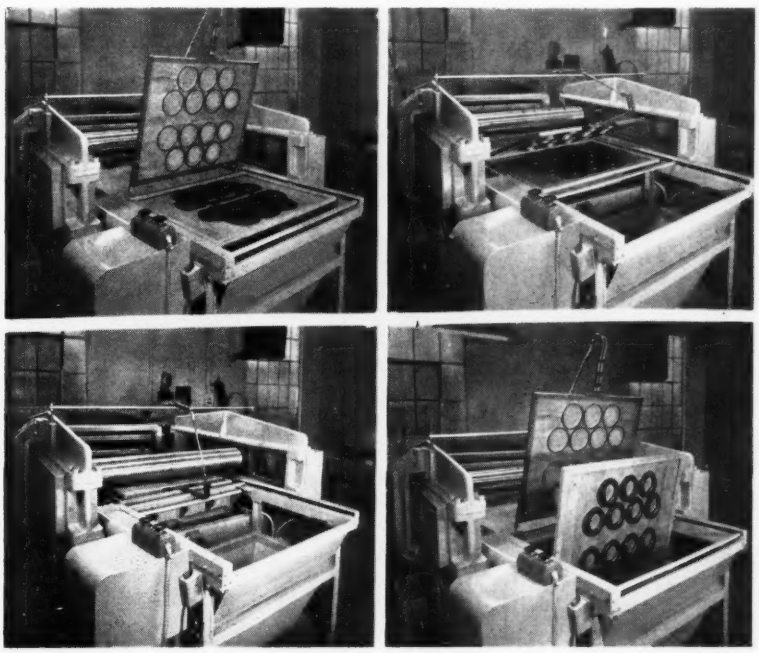
Simultaneously, two Bayer urethane chemists, Guenther Lowe and Harold Ebneth, are studying new technical developments at Mobay's New Martinsville, W. Va., plant research laboratory.

FEMC Roller Die Cutter Loading and Unloading Units

Automatic roller die cutter loading and unloading equipment has been announced by the special machinery division of Falls Engineering & Machine Co., Cuyahoga Falls, O. The equipment was particularly designed for use on roller die cutters doing production trimming of molded rubber goods, small automotive rubber parts, including brake pedals, accelerator pedals, spring pads, toy tires, and other small items.

The new equipment fits roller die models with bed sizes of 48 by 42, 48 by 72, and 48 by 84 inches. On the larger sizes, the loading and unloading mechanism may be attached to each end of the machine, enabling the machine continuously to die-cut stock at one end or the other.

The equipment includes a steel frame 36 by 30 inches, to which the dies are fastened. Powered by a motor-driven gear rack, the frame and the dies move fully loaded on to the bed of the die cutter. The cut is made, and frame and dies move off the bed, and the frame tilts, dropping the die-cut parts into a funnel-shaped hopper and to a tote pan, ready for pickup and inspection.



New FEMC automatic loading and unloading equipment for heavy-duty roller die cutter in operation. Upper left, top and bottom halves of the die-holding frames. Upper right, the dies and frame move on to the bed of the die cutter. Lower left, the roller moves over the dies, cutting the stock. Lower right, the frame holding the die-cut part tilts and drops the pieces into a tote pan.

Named to BDSA Reserve

The Business & Defense Services Administration of the United States Department of Commerce has named three more industry executives to its executive reserve unit, increasing the unit to 218, with a total of nine from the rubber industry.

The three are Harry M. Dannenbaum, Aldan Rubber Co., Philadelphia, Pa.; Walter J. Geldard, Naugatuck Chemical Division of United States Rubber Co., Naugatuck, Conn.; and E. D. Kelly, petrochemical division of The Firestone Tire & Rubber Co., Akron, O.

The reserves, all of whom have prior government experience, but are not now government employes, would serve with BDSA or a similar agency in case of a national emergency. These men have no obligations other than attendance during short periods of training. The first group was called for training late in January.

Monsanto Managers Study

An advanced management course for selected managers in its employ has been established by Monsanto Chemical Co., St. Louis, Mo. The course, to consist of two three-week sessions, is being given for more than 150 men at Excelsior Springs, Mo.

The purpose of the course is to "provide participants with a broader view of phases of business operations than they normally get in carrying out their particular duties with Monsanto," according to Francis J. Curtis, the company's vice president for personnel.

Atlas Building Tech Center

Construction of a $3,000,000 technical center has been begun by Atlas Powder Co., Wilmington, Del., in a move designed to double the firm's research and development strength within the next few years. Completion of the facility is expected before the end of 1957.

Technical studies and product development activities now being carried on at the company's central research laboratory at Atlas Point, Del., will be transferred to the new building, together with personnel of Atlas research and product development departments. The new technical center will provide working space for 200 employes. No production or pilot-plant activities will be conducted there.

Boonton Gets SPI Award

Boonton Molding Co., Boonton, N. J., has been awarded the grand prize for the best informative label in the second annual Informative Labeling Contest of the plastics housewares manufacturers division of The Society of the Plastics Industry, Inc.

The company received the top award for its hangtag for Boontonware, which also won the home-furnishings category award. Norman Anderson, SPI president, made the award at the semi-annual luncheon meeting of the SPI's housewares division at the Seneca Hotel, Chicago, Ill., January 19.

Cement-Latex Coatings

Modified latex emulsions which combine cement and cementitious materials are being made available as coatings for interior and exterior structural surfaces from Surco International Corp., Atlanta, Ga., according to The Goodyear Tire & Rubber Co., chemical division, Akron, O., whose Pliolite latex is being used in these coating materials.

Addition of the latex to the cement concentrates is said to provide flexibility, impact strength, water resistance, and improved adhesion to other surfaces. They will adhere to such surfaces as concrete, masonry, stone, wood, metals, and glass, among others.

Campco-Tafelglas License

Campco Division, Chicago Molded Products Corp., Chicago, Ill., has licensed Deutsche Tafelglas A.G., Furth/Bavaria, Germany, to manufacture Campco extruded rubber-modified styrene sheet. Campco will also train representatives of the German firm in this country in technical and merchandising methods. An exchange of ideas and machinery between the two companies was also provided for in the agreement. The styrene sheet has found application in the United States in the appliance, toy, display, automotive, and houseware fields.

New Wyandotte Polyethers for Polyurethane Foams

The development of a series of polyethers for use with toluene diisocyanate in the manufacture of polyurethane foams has been announced by Wyandotte Chemicals Corp., Wyandotte, Mich. The polyethers are made up of specially selected members of the company's Pluronic and Tetronic series of nonionic surface active agents.

Isocyanate-polyether foams have been available on the general market for more than a year. Cheaper in cost than their isocyanate-polyester counterparts, they are said to better resist aging in humid atmosphere.

Wyandotte's Pluronic series is composed of products prepared by the sequential addition of propylene and ethylene oxides to propylene glycol. The Tetronic series is similar except that ethylenediamine is substituted for propylene glycol in the preparation.

The Wyandotte polyurethane grades of polyethers are said to be block polymers with molecular weights ranging from 2,000 to 6,000. Both flexible and rigid polyurethane foams "of excellent appearance and promising properties" can be prepared from them, the company reports. These polyethers will be sold under the Pluronic trade mark by Wyandotte's Michigan Alkali Division.

Two other ingredients for compounding polyurethane foams have been announced by the company. They are an odorless catalyst derived from piperazine, and Quadrol, a cross-linking agent. The catalyst is said to enable the production of foams which are odor-free even immediately after manufacture. Quadrol, prepared by the condensation of four molecules of propylene oxide with ethylene diamine, is reported to offer promising rigid foams both with polyethers and with castor oil-based formulations.

USAF Matador Launchers Use Goodyear Terra-Tires

Tubeless "pillow-tires" manufactured by the aviation products division of The Goodyear Tire & Rubber Co., Akron, O., are being used on U. S. Air Force vehicles designed to transport and launch the new TM-61B Matador ground-to-ground tactical missile.

The tires, dubbed Terra-Tires, are 3½ feet long and 3½ feet in diameter and contain 3 to 15 pounds of controlled air pressure, far below conventional tire pressures. Eight of the tires are on a multi-purpose truck called the MM-1 Teracruzer which tows the second vehicle, called Translauncher, riding on four of the tires.

The mounting, suspension, and air-pressure control of the Teracruzer's eight Terra-Tires enable the vehicle to move over virtually any terrain with little shock transmitted to the Matador, its equipment, or its personnel, according to a joint announcement by Goodyear's aviation products division; Goodyear Aircraft Corp., which made the Translauncher semi-trailer; The Martin Co., prime weapon system contractor; and Four Wheel Drive Auto Co., builder of the eight-wheel-drive Teracruzer.

The Terra-Tires on the Teracruzer are mounted in pairs in such a way that forward tire bags can be tilted upward to act as compactors, packing down snow, mud, or sand when necessary. The pressure of the tires can be changed by the driver, even when the vehicle is in motion, to adapt to changing terrain.

Without altering its flat-bed or frame the Teracruzer is used to transport the missile nose, booster, testing, power, fuel, crane, general squadron cargo, communications, and supply packs which constitute Goodyear Aircraft's basic missile ground support system for the TM-61B.

All items of the missile ground-support system were developed for the Air Force's Air Research and Development Command, with technical guidance of Wright Air Development Center, for Tactical Air Command use with the Matador.

Monsanto-Emery Venture

Monsanto Chemical Co., St. Louis, Mo., and Emery Industries, Inc., Cincinnati, O., will jointly construct a plant for the fractionation of crude tall oil into unsaturated fatty acids and tall oil rosin at Monsanto's Nitro, W. Va., plant site.

To cost more than $4,000,000, the plant will be operated by Monsanto's organic chemicals division. Full-scale production at the facility is expected by the Spring of 1958. Also included in the agreement is St. Regis Paper Co., New York, N. Y., which will supply the crude tall oil from its Florida mills.

Emery Industries is said to be the largest United States consumer of unsaturated fatty acids in its production of dimer acid and other polybasic acids for surface coatings, plastic formulations, and other uses. The new plant will be an important source of the company's raw materials.

Machine Companies Merge

The Cleveland Automatic Machine Co., Cincinnati, O., has absorbed The J. H. Day Co., Inc., Cincinnati, builder of processing machinery for the rubber, chemical, and paint and varnish industries, among others, which will continue to operate as The J. H. Day Co. Division of The Cleveland Automatic Machine Co.

Cleveland Automatic, owned by R. K. LeBlond Machine Tool Co., manufactures a line of single-spindle automatic screw machines and high-pressure, hydraulic die casting machines.

Wooster Buys Jamestown

The Wooster Rubber Co., Wooster, O., has acquired Jamestown Finishing Products, Inc., Jamestown, N. Y., producer of plastics, plastic paints and coatings, and baked enamel finishes. The firm will operate as a wholly owned subsidiary of Wooster, under the name of Jamestown Finishes, Inc.

Jamestown had been a major supplier for plastic dips used by Wooster in the production of its Rubbermaid line of dish drainers and other coated wire items. Jamestown will produce houseware goods for national distribution in addition to its former products.

Stauffer in Reorganization

Stauffer Chemical Co., New York, N. Y., has integrated two of its subsidiaries, Nyotex Chemicals, Inc., and New York-Ohio Chemical Corp., into the parent corporation. Nyotex will be operated as Nyotex Chemicals Division of Stauffer and New York-Ohio Chemical has been made a part of Stauffer's industrial chemicals division.

Nyotex has its main facilities at Houston, Tex., producing anhydrous hydrogen fluoride and aluminum chloride. New York-Ohio plants are located at Niagara Falls, N. Y., Elkton, Md., and Dominguez, Calif., manufacturing aluminum chloride, antomony trichloride, and anhydrous hydrogen chloride. Sales of all of these products will be handled nationally by Stauffer's industrial chemicals division.

G-E Division at Sales Peak

The chemical and metallurgical division of General Electric Co., Pittsfield, Mass., achieved the highest sales level in its history during 1956, it was announced by Robert L. Gibson, vice president and divisional general manager.

Mr. Gibson said total sales of the division doubled since 1949, with increases of from 50% to more than 200% experienced by such new products as Irrathene irradiated polyethylene, Methylon resins, specialty grades of silicone products, vacuum melted alloys, and Alkanex wire enamel.

The division spent a million dollars more for research and development in 1956 than it did in 1955. Another million-dollar increment has been budgeted for this purpose for 1957.

AMA Research Division

A research and development division has been formed by the American Management Association, New York, N. Y. The new unit will carry out a program intended to help research and engineering executives improve their understanding of management principles.

C. Guy Suits, vice president and director of research, General Electric Co., Schenectady, N. Y., will head the new AMA division. He will be assisted by Philip Marvin, author, recently associated with American Viscose Corp.

The new division will offer a program of meetings, print publications, and hold conferences and seminars.

News About People

Theodore A. Lauer, E. F. Hutton & Co., has been reelected president of Commodity Exchange, Inc., New York, N. Y., and **Joseph Fischer,** Joseph Fischer & Co., has been reelected treasurer. **Frederick T. Koyle,** Carl M. Loeb, Rhoades & Co., was elected vice president representing the rubber group; and **William T. Baird, Jr.,** Baird Rubber & Trading Co., Inc., was elected to the board of governors to represent the rubber group. **Matthew S. Fox** was re-elected to the board also to represent the rubber group.

William A. Norman has been appointed Canadian technical sales service representative of Chemstrand Corp. and is making his headquarters with Fawcett & Co., Toronto, Ont., Canadian sales agent for the company.

Raymond J. Lodge and **Charles W. Smith** have been advanced to general managers of the resins and chemicals department and the Polyco-Monomer departments, respectively, of the chemical division of Borden Co., New York, N. Y. **Eugene J. Sullivan** has been promoted to general sales manager for the chemical division.

C. J. Kennett and **C. B. Lamb** have joined the development department at the South Charleston, W. Va., plant of Carbide & Carbon Chemicals Co., division of Union Carbide & Carbon Corp., as quality control statistician and quality control coordinator, respectively.

Samuel Hochberger, vice president and manager of the dock and warehouse department of Stein, Hall & Co., Inc., New York, N. Y., was tendered a testimonial dinner in honor of his forty-fifth anniversary with the company.

William A. Perry, Jr., has been assigned to the packaging films staff of The Goodyear Tire & Rubber Co., Akron, O.

George F. Pryor has been elected a member of the board of directors of The Sun Rubber Co., Barberton, O., filling the unexpired term of **Joseph L. McLane,** who died last spring.

Gerald Hill, sales manager of Goodrich International Rubber Co. in Manila, P. I., has been named manager of industrial products sales for International B. F. Goodrich, Akron, O. He succeeds **Edward P. Bonazzi,** who has retired.

Gavin A. Taylor has been made assistant sales manager of the butyl division of Enjay Co., Inc., N. Y. He joined the company in 1945 and did foreign sales work and new product development before being transferred to the butyl division.

E. S. Brockney has been appointed assistant sales manager for Polyflex 100 film and sheeting in the plastics division of Monsanto Chemical Co., Springfield, Mass. The styrene film was added to the company's line on January 1 through an exclusive distributorship agreement with Plax Corp.

John C. Dabney, formerly director of industrial development for the State of Florida, has been named director of marketing for American Machine & Foundry Co., New York, N. Y.

Norman D. Spilker, chief chemist for American Container Corp., Huntington, W. Va., has been named director of research.

Anthony J. Urbanic has been appointed assistant director of material development for The General Tire & Rubber Co., Akron, O. He joined the company in 1951.

George R. Williams has been appointed sales representative in the New York, N. Y., area for the organic chemical sales department of Emery Industries, Inc., Cincinnati, O.

R. W. Ward has been put in charge of all engineering and production for the plastics division of Nopco Chemical Co., Harrison, N. J. **Harry Marx** has been made responsible for urethane foam production; while Harry Rogers has assumed charge of the company's flexible foam development program.

J. W. L. Fordham, since 1955 senior chemist in the exploratory research department of Diamond Alkali Co., Painesville, O., has been appointed group leader in charge of monomers and polymers research.

Frank S. Griesinger has been assigned to special projects in conjunction with the service sales and equipment division, retread and repair materials section, The Goodyear Tire & Rubber Co., Akron, O. **Joseph C. Hofman, Jr.,** succeeds him as manager of retread and repair materials.

R. W. McCullough has been appointed manager of technical services, and **George J. Sella, Jr.,** has been named a sales representative for the rubber chemicals department of American Cyanamid Co.'s organic chemicals division, Bound Brook, N. J.

Ted W. Blaser, a sales engineer in B. F. Goodrich Aviation Products, Akron, O., has been advanced to manager of electrical products sales.

Harry F. McCarthy has been advanced to sales manager of the Pillo-Foam division of Dunlop Tire & Rubber Corp., Buffalo, N. Y.

Joseph E. Mayl, vice president, general products group, The Goodyear Tire & Rubber Co., Akron, O., has retired after 33 years of service with the firm. He has been succeeded by **Sam DuPree,** whose position as general manager of the industrial products division has been assumed by **R. B. Warren,** formerly sales manager of industrial products.



George R. Williams



Sam DuPree

Robert M. Morris has been named assistant general manager of the organic chemicals division of Monsanto Chemical Co., St. Louis, Mo., and has been succeeded as director of manufacturing for the division by **Howard L. Minckler. Russell L. Miller** replaces Mr. Minckler as John F. Queeny plant manager. **John F. Thompson** has been named general superintendent of inorganic division manufacturing in the William G. Krummrich plant. **Richard J. Kozacka** has been appointed manager of the company's Everett, Mass., inorganic chemicals division plant.

William J. Johnson has become president and general manager of Goshen Rubber Co., Inc., Goshen, Ind., succeeding the late Elmo E. Niccum. **Richard G. Bigler** has been appointed assistant to the president, and **Wayne Burger** has been named treasurer of the company.

Leo L. Bromley has joined Cellofilm Industries, Inc., Woodridge, N. J., as technical director.

Paul S. Greer, chief of the Rubber Research Group, National Science Foundation, and formerly chief of research and development for the Office of Synthetic Rubber, has become associate director of the chemical sciences division, Office of Ordnance Research, of Duke University, Durham, N. C.

Stephen L. Bender and **Arthur L. Waldie** have been appointed to the staff of the instruments division of North American Philips Co., Inc., Mount Vernon, N. Y.

David K. Homan has been appointed western representative for the original equipment sales department of The Seiberling Rubber Co., Akron, O.

Edward E. Schwegler has been elected a vice president of New Jersey Zinc Co., New York, N. Y., and will continue as comptroller, a position he has held since 1951.



Edward E. Schwegler

B. D. Thomas has been named director of Battelle Memorial Institute, Columbus, O. He succeeds **Clyde Williams,** president of the Institute.

Edward L. Mears has been appointed manager of the central services division of W. R. Grace & Co.'s Dewey & Almy Chemical Co., Cambridge, Mass.

U. T. Greene has been advanced to assistant director of commercial development for Diamond Alkali Co., Cleveland, O. Dr. Greene recently served as director of the Chemical and Rubber Division, Business & Defense Services Administration, United States Department of Commerce.

Herbert J. Due has been appointed assistant manager of zinc oxide sales for St. Joseph Lead Co., New York, N. Y.



Herbert J. Due



Haddad Studio

Newton H. Tuthill

Edward Lupsiewicz has joined the research and development department of Barrett Division, Allied Chemical & Dye Corp., New York, N. Y.

William H. Metzger has been appointed regional representative in charge of Caprolan polyamide fiber sales in the Pennsylvania-New York-New England area for National Aniline Division, Allied Chemical & Dye Corp., New York, N. Y. **William H. Poisson** has been named technical assistant to the company's director of fiber sales and service. **George B. Monk** has become representative-at-large for the Division; while **Daniel J. Bruce** has joined the company as market development supervisor.

George H. Kahl, Kenneth L. VanderVoort, and **John G. Sibley** have been named district sales managers in New York, N. Y., Chicago, and Charlotte, respectively, for the marketing department of Jefferson Chemical Co., Inc., Houston, Tex.

E. D. Buckley, since 1953 purchasing agent for Dunlop Tire & Rubber Corp., Buffalo, N. Y., has been advanced to manager of purchasing, succeeding **H. F. Van Valkenburgh,** who has retired as vice president in charge of purchasing.

Francis M. Parker has been named to director of marketing for American Viscose Corp., Philadelphia, Pa. Dr. Parker was formerly marketing director for the chemical division of Merck & Co., Inc.

William B. Wilson, an expediter and coordinator in the metal products division of The Goodyear Tire & Rubber Co., Akron, O., has retired after more than 54 years of continuous service with the company. He joined the firm in 1903 as an office boy at the age of 14.

Newton H. Tuthill has been appointed general manager of the hard rubber division of American Hard Rubber Co., New York, N. Y., and has been succeeded as executive vice president and general manager of Pequanoc Rubber Co., a wholly owned subsidiary of American Hard Rubber, by **Budd E. Pollak,** who retains his position as secretary of the parent company.



Budd E. Pollak



William J. Bolin



Albert W. D'Armond

Albert W. D'Armond has been appointed sales manager of Wabash Rubber & Plastics Corp., Seymour, Ind. He was formerly midwestern sales manager for H. O. Canfield Co., parent company of Wabash Rubber & Plastics.

W. Paul Eddy, chief of engineering operations at the Pratt & Whitney Aircraft Division of United Aircraft Corp., has been elected president of the Society of Automotive Engineers for 1957. He is a former vice president and former chairman of the Southern New England Section of the organization.

W. P. Emerson has been reassigned from the office to field sales in the Atlanta district of Carbide & Carbon Chemicals Co., New York, N. Y.; while **M. H. Mackay** has been transferred from Chicago to the Newark district.

Harold B. Gartner, plant superintendent for American Latex Products Corp., Hawthorne, Calif., has been advanced to vice president in charge of production.

William J. Bolin has been advanced to central district sales manager for American Zinc Sales Co., Columbus, O., with headquarters in Columbus. He joined the company in 1947.

Robert Paul Blaine, since 1952 technical service manager in international sales for B. F. Goodrich Chemical Co., has been named manager of international sales for Goodrich-Gulf Chemicals, Inc., Cleveland, O.

G. W. Cochrane and **C. G. Herion** have been reassigned as technical representatives to the San Francisco and Los Angeles sales districts, respectively, of Carbide & Carbon Chemicals Co., a division of Union Carbide & Carbon Corp., New York, N. Y.

John C. Moore has been appointed general sales manager of the Mansfield, Century, and Inland divisions of The Mansfield Tire & Rubber Co., Mansfield, O. **Carl B. Gibson** has been named general manager of the newly created merchandising division.

George P. Bosomworth, manager of the engineering laboratory of The Firestone Tire & Rubber Co., Akron, O., has been elected a fellow in the Institute of Radio Engineers "for contributions to the use of electronics in the rubber industry."

Wesley C. Ekholm has been advanced to general manager of manufacturing for the carbon black and pigment division of Columbian Carbon Co., New York, N. Y. **M. R. Howell** succeeds him as general manager of the company's Monroe, La., carbon black plant.



M. A. Gutierrez

Wesley C. Ekholm

F. L. Griffith and **F. W. Blanchard** have been elected vice presidents of Hewitt-Robins, Inc., Stamford, Conn., the former continuing as general sales manager of the industrial products divisions, the latter now responsible for manufacturing and engineering in the industrial products divisions.



Robert Paul Blaine



H. F. Van Valkenburgh

H. F. Van Valkenburgh has joined A. Schulman, Inc., Akron, O., as assistant to the president. He was vice president in charge of purchasing for Dunlop Tire & Rubber Corp. before his current assignment with the rubber and plastics firm.

Harold M. Straub has been promoted to manager of tire construction and design for B. F. Goodrich Tire Co., Akron, O.

Raymond G. Spain has joined Wyandotte Chemicals Corp., Wyandotte, Mich., where he will do research and development in elastomeric materials.

Berndt K. Lyckberg has joined the polymer chemicals division of W. R. Grace & Co. as general manager of its new high-density polyethylene plant in Baton Rouge, La. He was formerly manager of the chemical laboratories of Firestone Plastics Co.

Gordon W. McBride has joined Carbide & Carbon Chemicals Co., New York, N. Y., as technical coordinator with the company's Washington, D. C., staff.



Hodge Photos

Norman J. Johnson

Norman J. Johnson has been appointed executive vice president and general manager of Griffith Rubber Mills, Portland, Oreg., and its wholly owned subsidiary, Chemical-Proof Corp., Seattle, Oreg. **George C. Houghton** has been named vice president and general sales manager of both firms, and **Zina A. Wise, Jr.,** has become assistant sales manager.

Clarence A. Stiegman has been named director of product development of Hooker Electrochemical Co., Niagara Falls, N. Y. Dr. Stiegman was vice president and technical director of Oldbury Electro-Chemical Co. before its recent consolidation into Hooker.

William A. Reilly has been advanced to executive vice president of Sawyer-Tower, Inc., Boston, Mass.

Frank Capstick has joined the compounding laboratory of the industrial products division of Dunlop Canada, Ltd., Toronto, Ont. He was previously with Dunlop, South Africa.

J. Lee Marsh, since 1952 director of engineering for Carbide & Carbon Chemicals Co., New York, N. Y., has been named vice president for development. Dr. Marsh joined the company in 1933.

Wayne K. Galloway has been advanced to manager of pressure suits and Avtrim sales for B. F. Goodrich Aviation Products, a division of The B. F. Goodrich Co., Akron, O.

Frank S. Treco, Jr., has been promoted to sales manager of Clevite Harris Products, Inc., Cleveland, O., and is succeeded as Detroit sales engineer by **Ralph E. Koldhoff.**

Donald Starner has been named manager of sales and general accounting for B. F. Goodrich Aviation Products, Akron, O.

Myron S. Gelbach, Jr., treasurer and assistant secretary of Alco Oil & Chemical Corp., Cleveland, O., has been elected a director of the company. **William H. Coleman, E. A. Kilroy, Jr., George J. Morton, Frank E. Taplin, F. McCawley Tolin,** and **Tinkham Veale, II,** were reelected directors.

Charles W. Bayley, Jr., and **Austin I. Weber** have been added as research and development chemists to the staff of the coatings and adhesives department, chemical division, of Borden Co., New York, N. Y. **Philip E. Coyle, Jr.,** has been assigned as technical sales representative to the eastern New England territory for the department.

Mart B. Riggs, chief engineer in automobile tire development at The Goodyear Tire & Rubber Co., Akron, O., has been awarded the company's P. W. and Florence B. Litchfield Award of Merit for a suggestion concerning a new type of siping machine.

G. John Lambillotte has been named project engineer for Columbia-Southern Chemical Corp., Pittsburgh, Pa.

Paul W. Kollar has been appointed executive plant manager of Anchor Rubber Products, Inc., and Doan Mfg. Corp., both of Cleveland, O. He was previously head of his own consulting firm.

Eugene J. Sullivan, general manager of the resins and chemicals and the Polyco-Monomer departments of the chemical division of Borden Co., New York, N. Y., has been promoted to vice president in charge of sales for the division.

C. D. Chambers has been appointed assistant Chicago regional sales manager for T A B Engineers, Inc., Chicago, Ill., designer and installer of special equipment and machinery for automated process.

Tom Keenan has been named president of Plastic & Rubber Products Co., Los Angeles, Calif. **Ted Kyle** and **Don Dillion** have been appointed manager of Los Angeles sales and purchasing agent, respectively.

Charles W. Davies has been reassigned as technical sales representative to the New York, N. Y., office of the tire yarn division of American Viscose Corp., Philadelphia, Pa.

William J. Rothemich has been elected a vice president of Interchemical Corp., New York, N. Y. He was previously president of the company's textile colors division.

Leo Roth has joined The Swan Rubber Co., Bucyrus, O., as manager of product development and quality control for its rubber hose and extruded products division. He was formerly with Gates Rubber Co.



Jerome H. Fritz, Studio

Thomas J. Ellis

Thomas J. Ellis has joined Hale & Kullgren, Inc., Akron, O., as consultant in automotive and industrial rubber products. Previously vice president of Thermoid Co., he has also been associated with The Firestone Tire & Rubber Co.

C. G. Stupp, vice president of Barrett Division, Allied Chemical & Dye Corp., New York, N. Y., has retired after 40 years of service with Barrett. He started as a research chemist at the company's Edgewater plant.

Walter W. Tesch has been appointed a sales representative for The Stanley Chemical Co., East Berlin, Conn.

Oliver W. Nelson and **Arne C. Johnson** have been promoted to vice presidents of Botwinik Bros. of Mass., Inc., and Sherman Rubber Machinery Co., both of Worcester, Mass.

Arthur B. Tillman, since 1955 assistant works manager, operations, of the Painesville, O., plant of Diamond Alkali Co., Cleveland, O., has been promoted to electro-chemicals division operations manager.

H. B. Coons has been advanced to superintendent of the Niagara Falls, N. Y., plant of Carbide & Carbon Chemicals Co., New York, N. Y.

Robert E. Blackmore has been appointed technical sales representative for Rubber & Asbestos Corp., Bloomfield, N. J., with headquarters in Berwyn, Ill.

A. W. Sokolowski has been advanced to vice president of engineering for The Lanly Co., Cleveland, O., manufacturer of industrial heat processing equipment.

Louis Yaeger has been elected a member of the board of directors of Crown Cork & Seal Co., Inc., New York, N. Y.

Dewey H. Nelson has been promoted to sales manager of Becco Chemical Division, Food Machinery & Chemical Corp., Buffalo, N. Y. He succeeds **John F. Shea**, who died last year.

Alexander D. Lumsden has become eastern regional sales manager of the foam products division of Hewitt-Robins, Inc., Stamford, Conn. He will headquarter in New York, N. Y.

Roger S. Firestone, president, Firestone Plastics Co., Akron, O., was keynote speaker of a series of talks given at Dickinson College on "America at the Crossroads."

David G. Bernard has been named manager of container products in the container and chemical specialties division, Dewey & Almy Chemical Co., Cambridge, Mass. **Carroll F. White** and **Robert A. Clabault** have been appointed assistant managers.

News Briefs

Stewart Bolling & Co., Cleveland, O., has boosted the capacity of some of its rubber and plastic mixers by converting to compound-type drives that are said to have replaced bulky gear and pinion drives and external gearing. The basis of the new drive designs is double-enveloping worm gearsets, products of Cone-Drive Gears Division of Michigan Tool Co., Detroit, Mich., which effect more than twice as much load-carrying capacity with no additional housing space.

Universal Oil Products Co., Des Plaines, Ill., has reduced the price of its rubber antiozonants UOP 88 and 208 to $1.25 a pound, truck-load lots, east of the Rocky Mountains.

Sherman Rubber Machinery Co., Worcester, Mass., has been organized as a new division by Botwinik Brothers of Mass., Inc., for the manufacture of special rubber machinery and the sale of used and rebuilt machinery. John R. Busser heads the new division.

The Goodyear Tire & Rubber Co., aviation products division, Akron, O., is producing in quantity tubeless aircraft tires designed for Arctic operations. The tires were originally developed by Goodyear in conjunction with Wright Air Development Center for use on military aircraft in temperatures down to –65° F.

Stauffer Chemical Co., New York, N. Y., has announced the semi-commercial availability of titanium trichloride, which is believed to have potential application as a catalyst for the manufacture of isotactic polymers such as polystyrene, polybutene, and polypropylene.

Heyden Chemical Corp., New York, N. Y., has acquired Newport Industries, Inc., and will henceforth be known as Heyden Newport Chemical Corp.

Monsanto Chemical Co., St. Louis, Mo., has reduced the price of its Santicizer 140 and tricresyl phosphate primary plasticizers to 32½¢ a pound, tank-car quantities, and 36¢ a pound for 55-gallon drums in lcl lots.

United States Rubber Co., New York, N. Y., has begun delivery of what are reported to be the first air springs to be used on an American passenger car, the 1957 Cadillac Eldorado Brougham. The rubber and nylon-fabric diaphragms are being made at the company's Indianapolis, Ind., tire division plant.

The Dayton Rubber Co., Dayton, O., is offering free to users of foamed-in-place urethane formulations a nomagraph for quickly calculating material costs. The 5½- by 8-inch pad forms are copyrighted as Costimator.

Arrowhead Rubber Co., Downey, Calif., has been merged with Federal-Mogul-Bower Bearings, Inc., and will henceforth be known as the latter's National Seal Division, Downey Plant.

Vernay Laboratories, Inc., Yellow Springs, O., has announced a $750,000 expansion program, including the construction of a new plant which will more than double the firm's rubber molding capacity. At the same time, announcement of the appointment of A. C. Hoffman as executive vice president, and Kenneth C. Tregillus and George Asakawa as vice presidents of the company was made.

Du Pont Co. of Canada, Ltd., Montreal, P.Q., has been consolidated with its parent company, Du Pont Co. of Canada (1956), Ltd.

Dayton Rubber Co.'s Hillside, N. J., automotive product warehouse has been moved to 211 W. 61st St., New York, N. Y.

Nopco Chemical Co., Harrison, N. J., has formed a laboratory unit for the evaluation of new chemicals as vinyl stabilizer components.

B. F. Goodrich Rubber Co. of Canada, Ltd., has built a $325,000 office and warehouse in Vancouver, B.C. The two-story structure includes 40,000 square feet of warehouse space and 5,000 square feet of offices. A staff of about 30 will be housed in the 143- by 190-foot building, which is located at 3434 Cornett Rd.

Thiokol Chemical Corp., Trenton, N. J., has given financial assistance grants again this year to Polytechnic Institute of Brooklyn, Brooklyn, N. Y.; Drexel Institute of Technology, Philadelphia, Pa.; and Rider College, Trenton.

Hooker Electrochemical Co., Niagara Falls, N. Y., has discontinued the use of the designation Oldbury Division for the recently integrated Oldbury Electro-Chemical Co. The term "Oldbury Products," however, will continue to be used.

Montgomery Bros., Inc., Essington, Pa., has concluded an arrangement with UBS Chemical Corp., Cambridge, Mass., under which all Montgomery industrial adhesives and protective coatings will be manufactured by UBS.

The Seiberling Rubber Co., Akron, O., is doubling production of its Sealed-Aire and Safety premium passenger tires in the new 14-inch size. The Safety model is now being made with nylon cord, as well as rayon fabric.

United States Rubber Co., New York, N. Y., will build a 45,000-square-foot manufacturing, warehouse, and office addition to its Philadelphia, Pa., power transmission belt plant. Completion is scheduled for June.

Federal Color Laboratories, Inc., Cincinnati, O., is now selling its own organic colors to the rubber industry. Monsanto Chemical Co. previously had handled these sales.

Food Machinery & Chemical Corp., organic chemicals division, New York, N. Y., has assumed responsibility for FMC's Ohio-Apex Division, manufacturer of plasticizers.

The B. F. Goodrich Co., Akron, O., will appeal the recent decision of the Baltimore, Md., United States District Court dismissing a tubeless tire patent infringement lawsuit against United States Rubber Co.

Herron Bros. & Meyer, Inc., Hamilton Square, N. J., has sold its rubber compounding, research, and testing laboratories to Clarence B. Moore. The facility has been renamed Moore Laboratories.

Bristol Co., Waterbury, Conn., has opened a branch factory and warehouse in Houston, Tex., for the distribution of the firm's automatic controlling, recording, and telemetering instruments.

United States Rubber Co., textile division, New York, N. Y., has organized a nationwide chain of 23 textile distributors for Trilok, the company's three-dimensional upholstery fabric.

Boston Woven Hose & Rubber Co., Cambridge, Mass., has opened a new warehouse at 1925 Blake St., Denver, Colo., for servicing the Mountain States area.

Rubber Machinery, Inc., El Monte, Calif., has been organized by Kalmon Simon, formerly of S. G. Rubber Co. The firm will specialize in new and used rubber processing equipment.

Calkin & Bayley, Inc., New York, N. Y., has been organized as industrial consultants specializing in marketing and economic research, product and market development, business and plant surveys, and analysis and testing.

The Dayton Rubber Co., Dayton, O., is operating a new accelerated testing technique in its development program for special agricultural combine V-belts.

Financial

Alco Oil & Chemical Corp., Cleveland, O. Quarter ended December 31, 1956: earnings, $81,000; sales, $963,000.

The Armstrong Rubber Co., West Haven, Conn., and wholly owned subsidiaries. Year ended September 30, 1956: net profit, $2,797,963, equal to $1.80 a common share, against $2,734,133, or $1.74 a share, in the preceding fiscal year; net sales, $71,313,421, against $69,981,866; federal income taxes, $2,692,000, against $2,594,000; current assets, $35,032,645, current liabilities, $19,686,776, against $28,836,504 and $14,522,252, respectively, on September 30, 1955.

Dayton Rubber Co., Dayton, O., and subsidiaries. Year ended October 31, 1956: net profit, $2,593,003, equal to $3.59 a common share, compared to $2,321,477, or $3.44 a share, in the preceding fiscal year; net sales, $75,813,409, against $69,150,073; federal income taxes, $2,754,222, against $2,660,472; current assets, $29,939,943, current liabilities, $12,658,623, against $25,568,452 and $9,334,495, respectively, on October 31, 1955.

Dow Chemical Co., Midland, Mich., and subsidiaries. Six months ended November 30, 1956: net income, $24,565,545, equal to $1.00 a common share, against $28,339,615, or $1.22 a share, in the 1955 period; net sales, $307,309,509, against $272,971,210.

Raybestos-Manhattan, Inc., Passaic, N. J., and domestic subsidiaries. Nine months ended September 30, 1956: net profit, $2,691,433, equal to $4.28 a capital share, against $2,864,724, or $4.56 a share, in the 1955 months.

The Eagle-Picher Co., Cincinnati, O. Year ending November 30, 1956: net profit, $5,906,430, equal to $5.88 a share, compared with $5,004,062, or $5.06 a share, in the preceding fiscal year; net sales, $116,407,000, a record high, against $114,480,080.

Lee Rubber & Tire Corp., Conshohocken, Pa., and domestic subsidiaries. Year ended October 31, 1956: net earnings, $1,612,800, equal to $1.90 a capital share, compared with $1,750,071, or $2.06 a share, in the preceding fiscal year; net sales, $46,581,943, against $45,912,226; federal income taxes, $1,791,700, against $1,981,500; current assets, $22,669,138, current liabilities, $3,785,380, compared with $21,802,836 and $3,684,440, respectively, on October 31, 1955.

Seiberling Rubber Co., Akron, O., and subsidiaries. First nine months, 1956: net profit, $813,919, equal to $1.59 a common share, against $834,149, or $1.63 a share, in the like months the year before; net sales, $35,613,494, against $34,193,324.

A. G. Spalding & Bros., Inc., Chicopee, Mass. Year ended October 31, 1956: net profit, $773,922, equal to $1.31 a share, against $580,630, or $1.04 a share, in the preceding fiscal year.

Taylor Instrument Cos., Rochester, N. Y. Year ended July 31, 1956: net profit, $1,028,801, equal to $5.45 a share, against $1,190,690, or $6.30 a share, in the preceding fiscal year.

Quarter ended October 31, 1956: net income, $375,127, equal to $1.99 a share, contrasted with $54,745, or 29¢ a share, in the 1955 quarter.

Sheller Mfg. Corp., Portland, Ind. Nine months ended September 30, 1956: net earnings, $826,467, equal to 87¢ a capital share, contrasted with $2,679,546, or $2.81 a share, in the 1955 months; net sales, $29,337,154, against $39,191,504.

Sun Oil Co., Philadelphia, Pa. Nine months ended September 30, 1956: net earnings, $39,796,681, equal to $3.92 a share, against $36,972,079, or $3.83 a share, in the previous year's period.

Timken Roller Bearing Co., Canton, O. Nine months ended September 30, 1956: net earnings, $16,030,419, equal to $6.62 a share, against $16,216,176, or $6.70 a share, in the 1955 months.

U.S. Rubber Reclaiming Co., Inc., Buffalo, N. Y. Nine months to September 30, 1956: net profit, $120,850, contrasted with $270,967 in the 1955 period.

Union Asbestos & Rubber Co., Chicago, Ill. Nine months to September 30, 1956: net loss, $207,078, compared with net loss of $93,252 a year earlier.

West Virginia Pulp & Paper Co., New York, N. Y., and consolidated subsidiaries. Year ended October 31, 1956: net income, $16,331,000, equal to $3.19 each on 4,972,458 common shares, compared with $15,724,000, or $3.08 each on 4,934,888 shares, in the preceding fiscal year; net sales, $187,621,000, against $176,237,000; federal income taxes, $15,400,000, against $15,000,000; current assets, $48,680,000, current liabilities, $8,868,000, against $47,216,000 and $8,608,000, respectively, on October 31, 1955.

The Wooster Rubber Co., Wooster, O. Year ended September 30, 1956: net income, $1,366,553, equal to $1.26 each on 1,084,914 common shares, compared with $1,296,435, or $1.19 each on 1,033,492 shares in the preceding fiscal year; net sales, $19,674,957, against $15,939,202; U. S. and Canadian income taxes, $1,470,500, against $1,296,435; current assets, $5,644,888, current liabilities, $3,518,966, against $5,219,581 and $3,045,987, respectively, on September 30, 1955.

Timken Plans New Lab

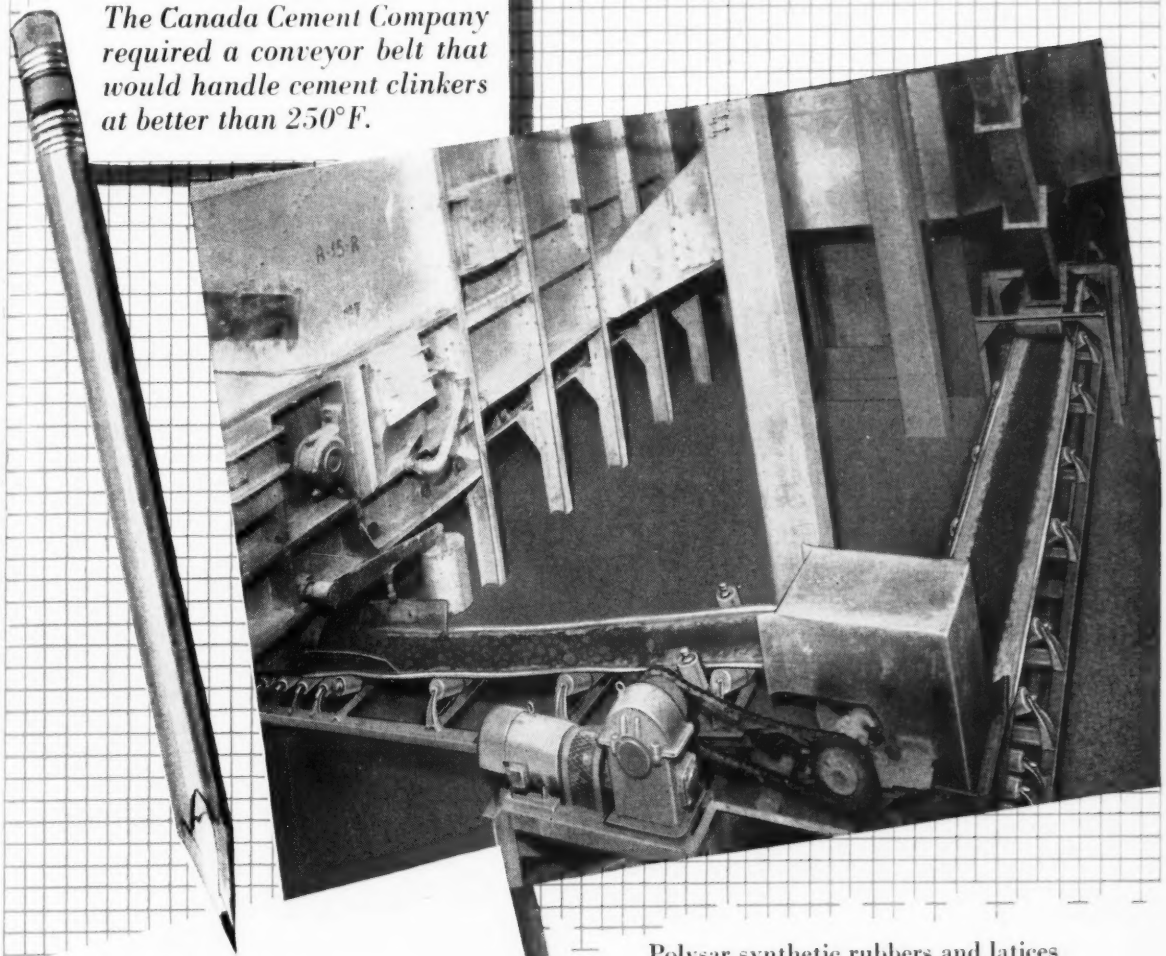
A new laboratory building will be erected by The Timken Roller Bearing Co., Canton, O., to house the company's physical, railroad research, electronic, photographic, and lubrication laboratories. To cost about $1,500,000, the two-story steel-frame structure will contain 20,000 square feet of floor space.

Included in the new facilities will be a 700-hp. transmission and axle dynamometer, cold and hot test rooms, six radial and thrust test machines, and a new universal testing machine.

Construction will start about May 1.

Problem

The Canada Cement Company required a conveyor belt that would handle cement clinkers at better than 250°F.



Solution

*Dunlop used *Polysar Butyl in its "Superhet" conveyor belting to achieve a 300% increase in serviceability.*

Polysar synthetic rubbers and latices have proved to be the answer to a wide variety of industrial problems. Manufacturers have found that it pays to investigate the technical advantages of the various types of Polysar rubber. Whether rubber is now used in your product or not versatile Polysar could be the answer to your design problem. Why not discuss your needs with our technical staff? Contact the Sales and Technical Service Division.

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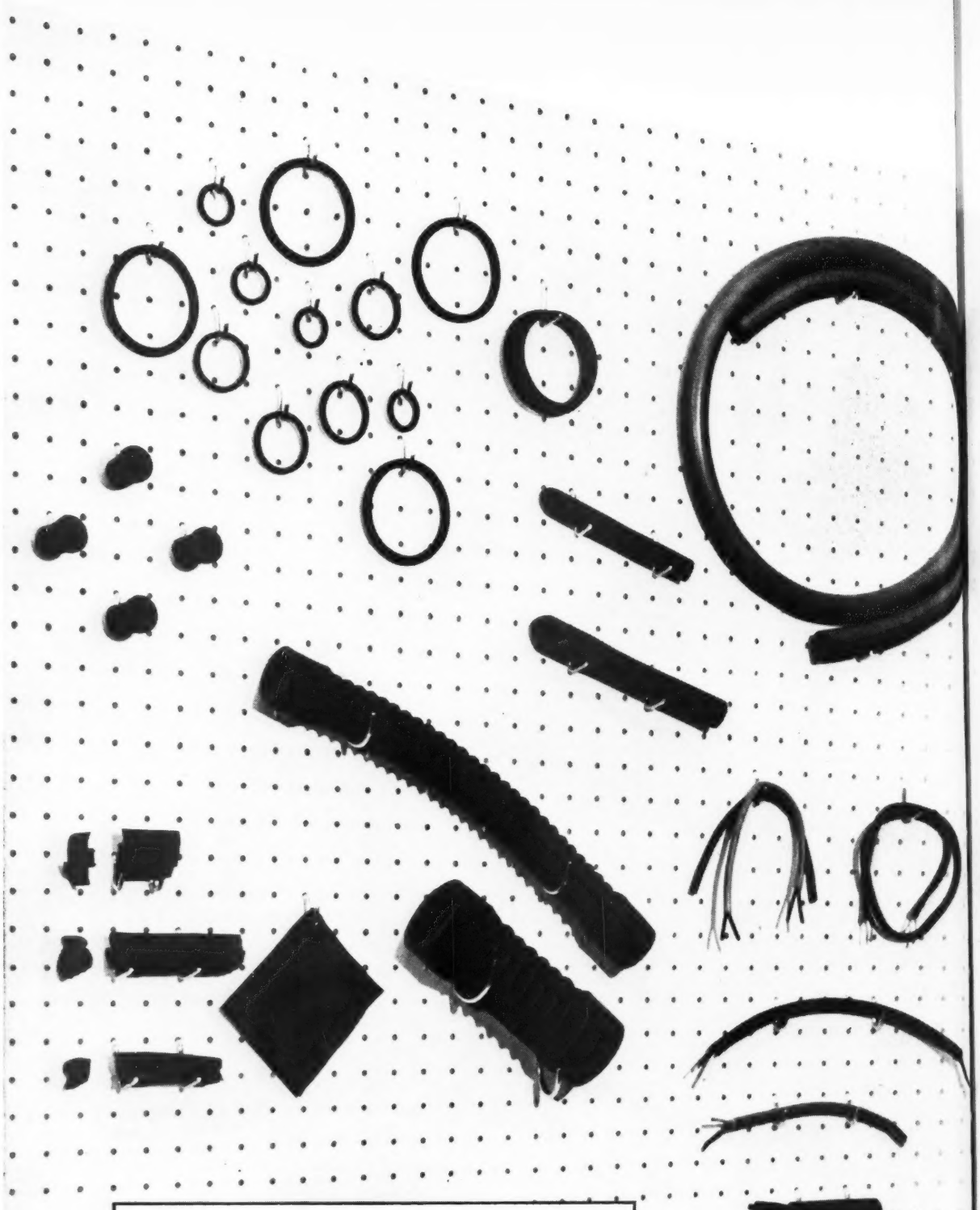
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***POLYSAR RUBBERS—General Purpose (hot, cold and oil extended)... Special Purpose... Latices... Oil Resistant... Butyl**

POLYMER CORPORATION LIMITED

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NOTHING PERFORMS LIKE RUBBER — *The best buy for your money*



Because New Sundex-85 gives more Neoprene WHV compound at a lower cost, you can afford to make a greater variety of products... hoses, gaskets, grommets, sealing and packing materials, weather stripping, wire sheathing, and many other mechanical goods.

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As much as 100 parts of Sundex-85 to 100 parts of neoprene hydrocarbon have been used successfully. Sundex-85 also conditions the compound for easy handling during processing.

Even with unusually high loadings of Sundex-85, neoprene products maintain their high resistance to oil, grease, ozone, heat, and sunlight. It helps assure quality in oil-resistant automotive and industrial hose, sealing and packing materials, gaskets, grommets, and other molded goods where cost is a strong factor.

Sundex-85 is compatible with neoprenes, natural rubber, butadiene-styrene type, and acrylonitrile polymers. Here are some of its typical properties:

Viscosity, SUS at 210F	90
Specific gravity at 60F	1.017
Refractive index, n_D^{20}	1.5869
Aniline point, deg F	90
Color	Dark

FOR COMPLETE INFORMATION about Sundex-85, ask your Sun representative, or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. RW-2.

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Obituaries

Urban H. Parker

Urban H. Parker, plant manager of the Keokuk, Iowa, plant of Dryden Rubber Division of Sheller Mfg. Corp., died December 15 in an Iowa City, Iowa, hospital, following a heart attack.

Mr. Parker attended Middlebury College, from which he was graduated in 1918 with a B.A. degree in chemistry. He began his career in industry with E. I. du Pont de Nemours & Co., Inc., and later became associated with Miller Rubber Co., Inland Mfg. Co., Feather Edge Rubber Co., The B. F. Goodrich Co., and The Firestone Tire & Rubber Co., successively. He assumed the position he held at the time of his death in 1937.

Mr. Parker was a founder and first president of the Chicago Rubber Group. A past member of the American Chemical Society, he also held memberships in the Keokuk, Rotary, and Keokuk Country clubs, the Elks, Hardin Lodge No. 29, A. F. & A. M., Zarapath Consistory, Valley of Davenport, Orient of Iowa, and Kaaba Shrine at Davenport. In addition, he belonged to the Keokuk Chamber of Commerce and was a director of Keokuk Savings Bank & Trust Co. and a member of the Graham Hospital board of trustees.

The deceased was born in Morrisville, Vt., on January 23, 1895.

Funeral services were held December 18 at the St. Paul Evangelical and Reformed Church, Keokuk. Burial took place the following day in Mount Peace Cemetery, Akron.

Mr. Parker is survived by his wife, a daughter, two sisters, and a brother.

Ralph K. Guinzburg

Ralph Kleinert Guinzburg, president of the I. B. Kleinert Rubber Co., New York, N. Y., died January 15 of a heart attack.

The deceased, whose grandfather, Isaac B. Kleinert, founded I. B. Kleinert in 1871, was an early advocate of putting notions departments in department stores and believed in expansive advertising and merchandising methods.

Mr. Guinzburg attended Cornell University and briefly served as a reporter on the *Evening Mail*. He was later editor and publisher of the *Westchester County Budget*.

He joined I. B. Kleinert in 1915 as assistant treasurer and was advanced to vice president before succeeding his father, Victor, as president in 1928.

In World War I, Ralph Guinzburg was assistant advertising manager of the Liberty Loan campaign for the Third Federal Reserve District. After World War II, he was chairman of the New York City



Ralph K. Guinzburg

United Service Organizations and of the Committee for Coordinating Jewish Community Services for Veterans. Mr. Guinzburg was also a past president of the National Notion Association. He was a secretary of the National Jewish Welfare Board and president of its metropolitan section and was a past-president of the Jewish Family Service and a trustee of the Federation of Jewish Philanthropies. He held memberships in the Young Men's and Young Women's Hebrew Association, the Citizens Budget Commission of New York, the American Jewish Committee, the National Republican Club, and the Harmonie Club.

He was born in New York, N. Y., on February 11, 1891.

He is survived by his wife, two daughters, two brothers, and four grandchildren. An only son, Lieut. Ralph V. Guinzburg, was killed during World War II while serving with the U. S. Air Force.

Funeral services were held for Mr. Guinzburg in Temple Emanu-El, New York, on January 18. Burial was at Ferncliffe Cemetery, Hartsdale, N. Y.

Harmon Connell

Harmon Connell, since 1952 compounding manager at the Natchez, Miss., plant of Armstrong Tire & Rubber Co., died December 31 from burns received in a laboratory fire.

At the time of his death, Mr. Connell was the first chairman and had been one of the founders of the Southern Rubber Group.

He was born in Eufaula, Ala., on February 20, 1916. The deceased was graduated from Mississippi State College in 1939 with a B.S. degree in chemistry and thereupon joined Armstrong in Natchez as a production employe. He was transferred to the company's laboratory in 1940. He served with the Chemical Warfare Department of the U. S. Army in the European and Pacific theaters of operation between 1942 and 1946, attaining the rank of captain. He was made assistant to the chief chemist upon his return to Armstrong and was advanced to compounding manager six years later.

Mr. Connell was a member of the American Chemical Society and was a past High Priest of the Royal Arch Masons of the Natchez Chapter.

Funeral services were held January 1, 1957, at Foster's Funeral Home, Eufaula. He was buried the same day in his family's plot in City Cemetery.

Mr. Connell is survived by his wife, two sons, and two sisters.

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Mexico

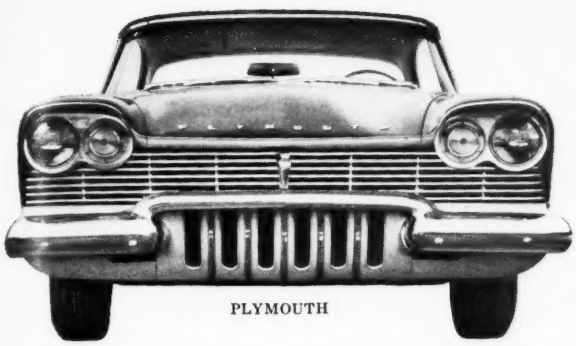
Fabricating Industry Grows; Rubber Planting Planned

While, on the whole the Mexican rubber industry progressed during 1955, the sudden spurt in the price of natural rubber restricted activity in certain fields. Recently released figures show that whereas the tonnage of natural rubber imports in 1955 increased by only 5% as compared with 1954 imports, total costs rose by 57%. As a result, the output of general rubber goods was held to about the same level as in 1954; while production of inner tubes dropped 8.7%.

Practically the entire increase in the value of total 1955 output, estimated at 16% above the 1954 figure, must therefore be ascribed to automobile tires, the manufacture of which rose from 914,946 units in 1954 to 1,013,260 units the following year, or 11% more by quantity. At the same time, the number of employes in the rubber industry increased by 9%.

In the first half of 1956, activity continued at an accelerated pace, and 13,207 metric tons of natural and synthetic rubber, valued at 108,500,000 pesos, were imported, as compared with 10,702 metric tons, value 82,600,000 pesos, in the same period the year before.

The high prices of natural rubber have made local manufacturers once more acutely aware of their dependence on foreign sources for their prime raw material, and there is a growing desire to replace the costly imports by a home-grown product. Attempts to produce rubber in Mexico have been made from time to time, and latest reports state that a new three-year plan has been developed for planting rubber on a large scale in suitable areas of the Tabasco, Chiapas, Veracruz, and Oaxaca states. Exact details are lacking, and there is no indication as to the type of rubber-bearing tree that will be planted, beyond the statement that it will be of a high-yielding type.



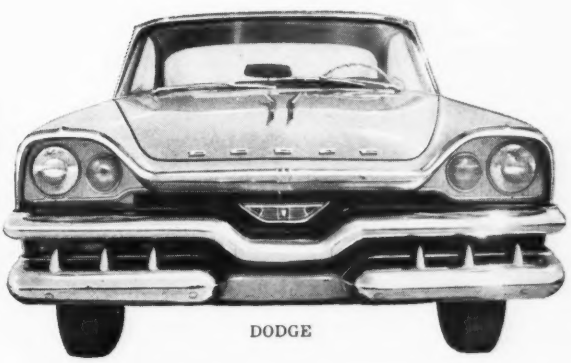
PLYMOUTH



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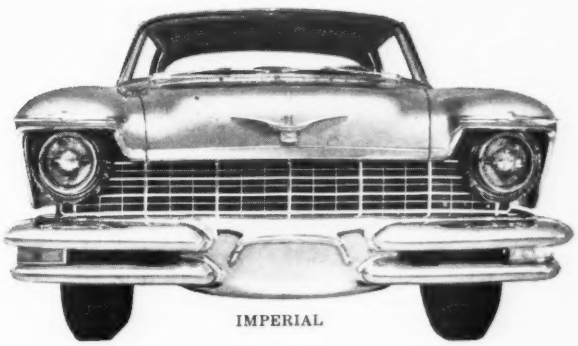


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Each one of the beautiful '57 Chrysler Corporation cars features Enjay Butyl weather-stripping on the big, wrap-around windshield and rear window. With Enjay Butyl's outstanding resistance to aging, moisture and sunlight, you can count on perfect performance for the life of the car.



IMPERIAL

FRONT AND REAR... ENJAY BUTYL RUBBER WEATHER-STRIPPING SEALS FOR SURE!

Come rain or shine, Enjay Butyl, the weather-proof rubber for window weather-stripping out-performs and out-lasts *all other* rubbers, synthetic or natural. *Moisture-proof* and *impervious to sunlight*, this is the rubber that combines outstanding shock resistance with unparalleled life-expectancy.

In more than 100 places on today's new cars, Enjay Butyl has demonstrated its profitable advantages over all other rubbers. Under the hood . . . in chassis and body... parts made from this super-durable, all-weather rubber have helped make today's new cars safer, more comfortable, and mechanically more sound. For further information, and for expert technical assistance, contact the Enjay Company.

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Enjay Butyl is the greatest rubber value in the world . . . the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

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CALENDAR of COMING EVENTS

February 15
Chicago Rubber Group. Furniture Club, Chicago, Ill.

February 8-9
Southern Rubber Group. Dallas, Tex.

February 19
Elastomer & Plastics Group, Northeastern Section, ACS. Student's Night. Science Park.

March 5
The Los Angeles Rubber Group, Inc. Biltmore Hotel, Los Angeles, Calif.

Buffalo Rubber Group. Spring Meeting. Hotel Westbrook, Buffalo, N. Y.

March 6-15
American Toy Fair. New York, N. Y.

March 15
Chicago Rubber Group. Furniture Club, Chicago, Ill.

Boston Rubber Group. Spring Meeting. Hotel Somerset, Boston, Mass.

March 17
Northeastern Section, ACS, and Its Elastomer & Plastics Group. Joint Meeting. Symposium on Adhesives.

March 18-21
Society of the Plastics Industry, Inc. 1957 National Conference and Pacific Coast Plastics Exposition. Biltmore Hotel, Los Angeles, Calif.

March 20
Washington Rubber Group. Pepco Auditorium, Washington, D. C.

March 20-22
Society of Automotive Engineers. Production Meeting & Forum. Buffalo, N. Y.

March 21-23
Division of High Polymer Physics, APS. Seventeenth Meeting. University of Pennsylvania, Philadelphia, Pa.

March 22
New York Rubber Group. Spring Meeting. Henry Hudson Hotel, New York, N. Y.

March 28
Commercial Chemical Development Association. Annual Open Meeting—"The Plastics Industry." Hotel Statler, New York, N. Y.

April 2
The Los Angeles Rubber Group, Inc. Biltmore Hotel, Los Angeles, Calif.

April 5
Akron Rubber Group. Spring Meeting. Sheraton Mayflower Hotel, Akron, O.

April 8-10
American Society of Mechanical Engineers. Spring Meeting. Hotel Dinkler-Tutwiler, Birmingham, Ala.

April 11
Fort Wayne Rubber & Plastics Group. Van Orman Hotel, Fort Wayne, Ind.

April 12
Detroit Rubber & Plastics Group, Inc. Spring Meeting.

April 14-27
United States World Trade Fair. Coliseum, New York, N. Y.

April 16-18
American Institute of Chemical Engineers, American Nuclear Society, American Society for Testing Materials, Society for Non-Destructive Testing. Symposium on Nuclear Tests for Non-Destructive Testing Applications. Morrison Hotel, Chicago, Ill.

April 16
Elastomer & Plastics Group, Northeastern Section, ACS. Trip to Owens Corning Fiberglas Plant, Ashton, R. I.

April 17
Washington Rubber Group. Pepco Auditorium, Washington, D. C.

April 26
Chicago Rubber Group. Furniture Club, Chicago, Ill.

April 29-May 3
American Material Handling Society Conference; Materials Handling Exposition. Convention Hall, Philadelphia, Pa.

May 7
The Los Angeles Rubber Group, Inc. Biltmore Hotel, Los Angeles, Calif.

May 10
Buffalo Rubber Group, and Ontario Rubber Section, CIC. International Meeting. General Brock Hotel, Niagara Falls, Ont., Canada.

May 14-16
Armour Research Foundation and *Nucleonics Magazine* Second Annual Industrial Nuclear Technology Conference. Museum of Science & Industry, Chicago, Ill.

May 15
Washington Rubber Group. Pepco Auditorium, Washington, D. C.

May 15-17
Division of Rubber Chemistry, ACS, and Rubber Division, CIC. Joint Meeting. Sheraton-Mt. Royal Hotel, Montreal, P.Q., Canada.

May 20-23
Design Engineering Show; Conference of Machine Design Division, ASME. Coliseum, New York, N. Y.

May 21
Elastomer & Plastics Group, Northeastern Section, ACS. Annual "Short Talk" Symposium.

May 22-24
American Society for Quality Control. Eleventh Annual Convention and Exposition. Masonic Temple, Detroit, Mich.

June 6
New York Rubber Group. Outing. Doerr's Grove, Millburn, N. Y.

June 7
Fort Wayne Rubber & Plastics Group. Outing. Lake Tippecanoe, Leesburg, Ind.

June 7-9
The Los Angeles Rubber Group, Inc. Summer Outing. Sahara Hotel, Las Vegas, Nev.

June 9-13
American Society of Mechanical Engineers. Semi-Annual Meeting. Sheraton Palace Hotel, San Francisco, Calif.

June 11
Buffalo Rubber Group. Outing.

June 14
Boston Rubber Group. Outing. Andover Country Club, Andover, Mass.

June 21
Akron Rubber Group. Outing. Firestone Country Club.

June 28
Detroit Rubber & Plastics Group, Inc. Outing.

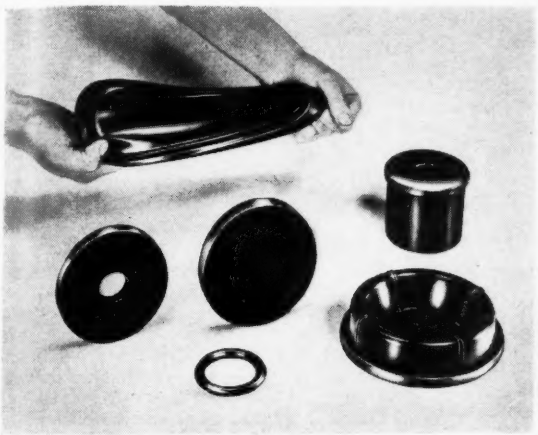
August 1
New York Rubber Group. Golf Outing. Baltusrol Golf Club, Springfield, N. J.

September 11-13
Division of Rubber Chemistry, ACS. Hotel Commodore, New York, N. Y.

September 18-20
National Bureau of Standards, Catholic University of America, Applied Physics Laboratory of Johns Hopkins University. Symposium—"Formation and Stabilization of Free Radicals." National Bureau of Standards, Washington, D. C.

September 23-25
American Society of Mechanical Engineers. Fall Meeting. Hotel Statler, Hartford, Conn.

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GASKETS AND DIAPHRAGMS molded from "Thiokol" Synthetic Rubbers are highly impermeable to moisture, gases and most aliphatic and aromatic liquids.



LOW TEMPERATURE FLEXIBILITY. "Thiokol" synthetic rubbers have a broad service temperature range, running all the way from —60°F., without the use of low temperature plasticizers, to +250°F.

Versatile "Thiokol" Synthetic Rubbers Have Wide Range of Applications

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- Paint Spray, Gasoline and Aromatic Fuel Hose
- Coated Paper Gaskets
- Printing and Coating Rollers
- Permanent Putties
- Molded Diaphragms and Gaskets

"Thiokol" Synthetic Rubbers provide:

- resistance to oils and solvents
- low temperature flexibility
- resistance to sunlight, ozone and aging
- impermeability to gases, moisture and liquids
- adhesion as putties to glass, metals, wood and plastics

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Coated Paper Gaskets. Inexpensive paper gaskets are made tough and oil-resistant with uncured "Thiokol" synthetic rubber. Coating is accomplished quickly and easily by rolling, spreading or dipping.

Printing and Coating Rollers. Outstanding resistance to swelling in aliphatic and aromatic solvents makes "Thiokol" synthetic rubber ideal for fabrication of lacquer, paint and inking rollers.

Permanent Putties. Versatile putties made from "Thiokol" Synthetic Rubbers have found wide acceptance in the building, marine and maintenance fields. They resist major causes of deterioration, including solvents, chemicals, sunlight, aging and weathering.

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PIONEER MANUFACTURERS OF SYNTHETIC RUBBER

News from Abroad

Malaya

Rubber Prices and Prospects

The upturn in the natural rubber market in the latter part of 1956 brought the average price for the last quarter of the year over the dollar (Straits) mark again. This news was good for the Federation's 320,000 plantation workers whose pay for a given quarter is fixed according to the average price of rubber during the preceding quarter and who, therefore, are getting an average raise in wages of 33 cents daily for the first quarter of 1957. This increase will cost employers $8,000,000 (Straits) more in wages for the period, an added expenditure which will not be viewed without some misgivings by those in the industry who have constantly been warning about the need to keep production costs low in order to be able to compete with synthetic rubber.

The possible effect on the industry if wages go much higher was pictured at a recent meeting in London of Anglo-Asian Rubber Plantations, Ltd., by the chairman, P. B. L. Coglan. Large areas of old, low-yielding rubber—of which there is still a very large proportion in Malaya, he said—would have to stop production because of inability to stand the extra labor costs. Before synthetic rubber became a competitor, such an occurrence was not disturbing, because the resulting reduction in output would eventually help to raise the price of rubber, when these areas would be able to go back into economic production. But now, the effect would merely be to stimulate the use and production of more synthetic rubber. He hoped that the Malayan unions would realize the situation and that the results to rubber workers of wage demands not in keeping with economic facts, might well be unemployment.

Incidentally, a local Chinese businessman and councillor of the Federal Legislature, Toh Eng Hoe, who recently returned from a trip to the United States where he visited a synthetic rubber factory, stated that as a result of what he had seen, he had come to the conclusion that Malayan rubber companies must be able to produce rubber profitably at 54 Straits cents a pound if they want to survive. Mr. Toh compared the American plant area of some 300 acres, and the 1,350 workers required for the manufacture of 180,000,000 pounds of synthetic rubber, with the 180,000 acres, 45,000 tappers, and 10,000 other estate workers needed to produce the same amount of natural rubber. At the same time he pointed out that a synthetic rubber plant took about a year to go into production and began making a profit in its second year; whereas a rubber estate was in its eighth year before it gave a good return—if the price was favorable.

More Rubber Land Urged

Once again the government is being urged to set aside land for rubber planting. A speaker in the Selangor State Council warned that if a decision on a realistic land policy for rubber was not quickly reached, capital would be attracted to the Gold Coast, Nigeria, and like countries. A five-year program was demanded for the expansion of the country's economy, and it was insisted that at least 1,000,000 acres of what is now waste land should be earmarked for allotment to the rubber and tin industries.

At practically the same time the Minister for Agriculture was discussing a plan for destroying thousands of acres of rubber trees in northwest Malaya to make way for rice. It seems that the rubber has been planted in the country's natural rice belt; the government aims at resettling padi planters here and returning them to their former status of prosperous, mixed farmers while at the same time it hopes to increase the supply of rice and other foodstuffs for the country's growing population. Since the former rice planters took up rubber, it is claimed, they have gone backward, economically, because they have completely neglected the profitable sidelines of poultry-keeping and fruit-growing as well as the cultivation of rice. The government has assured those who give up their rubber in the rice belt that they will get new land for rubber planting.

Faith in Malaya

A number of British rubber companies operating in Malaya have sold their estates in the last year or so, and probably a dozen more are either weighing the advisability of doing likewise or are already entertaining offers for all or part of their properties, examination of recent company reports reveals. These actions are part of a trend with some British companies to reduce capital investment in Malaya. Several of the companies which have sold out in Malaya are now investing in other undertakings elsewhere, but so far it has not been noted that any have taken up rubber-growing outside of Malaya.

In view of the above trend the proposed formation of a $1,250,000 (Straits) company to start a rubber estate on 1,500 acres of jungle land in Kelantan is of interest. Last summer shareholders of Kampong Kuantan Rubber Co. had been informed of the contemplated step, and now it is learned that this company and Semenyih Rubber Estate are forming the new company, which will be a subsidiary of Kampong Kuantan. Authorized capital will be £150,000 and Kampong will take by far the larger part of the shares.

It is calculated that it will cost £100 to bring an acre of high-yielding rubber into bearing, and that it will take 7-8 years before the trees produce on a commercial scale.

Packing Ordinance Protests

The Rubber Packing & Shipping Ordinance (1950), introduced to insure that rubber exported from Singapore be of good quality and properly packed, is being attacked and defended with equal vigor by Singapore's two rubber trade associations. The Singapore Rubber Trade Association said the Ordinance was doing more harm than good and should be withdrawn; buyers were exploiting the Association, taking advantage of the ordinance to make unnecessary claims. The Singapore Chamber of Commerce Rubber Association, on the other hand, found there had never been greater need of strict enforcement of the Ordinance than now. In 1954, it pointed out, the Malayan Rubber Export Registration Board, which enforces the Ordinance and deals with claims, received four complaints from overseas buyers; in 1955 there were 63 claims, and during the first 11 months last year 153 claims were made. Reputable packers, it added, had nothing to fear from the Ordinance, which should be more rigidly enforced if Malaya wished to regain its prewar reputation.

Meanwhile it is learned that the Singapore Rubber Trade Association has appointed a five-man delegation to take up the matter with the government.

Repercussions from Sumatra?

The disturbances in Sumatra that have recently been making the headlines are viewed with mixed feelings here. Apart from the effect on the local rubber market, serious trouble in Sumatra could quickly restore Malaya to her former position of premier producer of natural rubber.

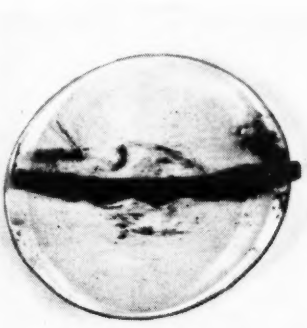
There are other considerations, however, and Singapore at least, cannot view with equanimity the possibility of losing the export business of the most important rubber center in Indonesia, to say nothing of the loss to the local remilling industry if the chief source of slab completely stopped shipment. In the first 10 months of 1956, Sumatra was responsible for $722,100,000 (Straits) out of the total of $1,160,800,000 representing rubber trade between Malaya and Indonesia. In the first 11 months of last year, Sumatra exported 58% of the total of 334,384 tons of rubber entering Malaya from Indonesia; and she is the biggest supplier of No. 1 sheet for reexport.

Rubber Industry Notes

Rubber shipments from Malaya during 1956 totaled 983,060 tons, or about 1% less than in 1955, available figures indicate.

KEL-F® ELASTOMER
IS SHATTERING IDEAS ABOUT RUBBER

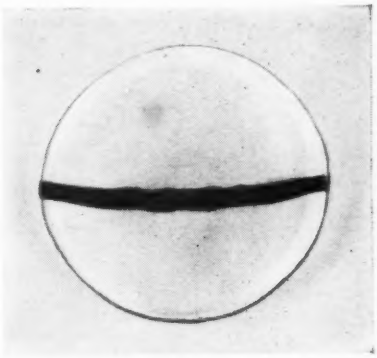
Challenging new fluorocarbon rubber has outstanding...
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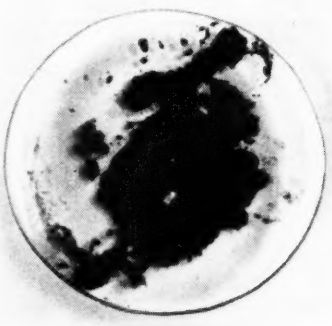
BUNA-N—10 min. immersion in RFNA



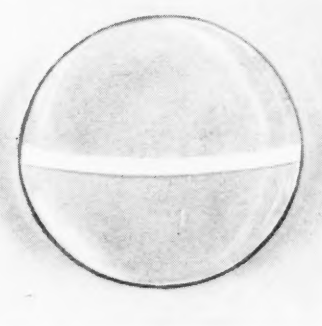
NATURAL RUBBER—10 min. immersion in RFNA



BUTYL—2 hr. immersion in RFNA



GRS—10 min. immersion in RFNA



KEL-F ELASTOMER—one week immersion in RFNA

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If your work requires an elastomer with outstanding resistance to heat and corrosion, look into KEL-F Elastomer. Our technical staff is prepared to assist designers, engineers, and production men in adapting KEL-F Elastomer to their individual needs. Kellogg supplies KEL-F Elastomer in the gum form only. Names of qualified fabricators of specific end uses of KEL-F Elastomer are available on request.

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A 20% protective tariff has been imposed on latex foam and its products, it is learned. As a result, local production and sales of foam products are expected to expand; an increase in the number of factories from the existing three to at least five is looked for, and also a drop of between 15 to 20% in the retail price of the products here. It is also hoped gradually to be able to build up an export trade for foam goods produced in Malaya.

Indonesia

Java Estates, Ltd., Losses

What the continued unrest in Java can mean to European companies directly affected is illustrated by the latest report of Java Amalgamated Rubber Estates, Ltd. This company, which before the war owned three well-developed and prosperous estates, has since suffered the loss of two of them, not to mention other losses.

During the Japanese occupation, rubber trees were heavily overtapped, especially on one estate, where this initial damage was compounded later on by squatters, pillage, robbery, and murder, and conditions became so impossible that in 1953 the company—to prevent further loss—gave up the estate to the Indonesian Government for the equivalent of £7,400, a sum which the company has so far not been permitted to remit to Britain. Reoccupation of the second estate, which before the war had 1,600 acres of mature *Hevea* seedlings, has so far not been feasible, since more than 1,000 acres, including all young and replanted rubber, have been completely uprooted, and buildings destroyed; it is thought that this estate may never be worth operating again.

Because of this situation, the company is reducing its capital; 12s. is to be written off from each of the 185,000 issued shares of £1 each, and it is proposed that the total of £111,000 be applied to writing down the book cost of the company's investment in Indonesia from £140,154 to £29,154, now held to be the maximum value of the investment.

Several other British rubber companies operating in Indonesia are in difficulties because they cannot remit assets or profits from Indonesia. Kasintoe Rubber Estates, Ltd., in voluntary liquidation, is a wholly owned Indonesian subsidiary with funds amounting to about 140,000 rupiahs; yet its shareholders may receive no more than 4d., for each of their £1 shares, that is 1⅔% of the face value.

Insulinde (Sumatra) Rubber Estates, which has net assets in Indonesia equivalent to £23,000 and had a surplus for 1955 of £6,412, was able to transmit only £1,507 to the United Kingdom. The company has considered amalgamation with another Indonesian company, or liquidation, but in either case exchange restrictions would not make it possible to transfer any worthwhile amounts.

Heavy taxes add to the troubles of foreign companies in Indonesia. At a meeting of Paras (Sumatra) Rubber Estates, Ltd., the chairman explained to shareholders why the company with 5,300 acres of mature rubber, an issued capital of £262,916, and profits of £100,385 in 1955, was able to pay debenture interest of only 2% less tax. Out of the profit, he said, the company had to pay £65,513 in Indonesian tax, and £3,493 in United Kingdom tax. In addition, the company had to deposit 40% of its net profit in the Bank of Indonesia, a sum that would only be released when a similar amount had been spent on capital items; the Indonesian Government is the sole arbiter of what could be regarded as capital expenditure. Another difficulty, the chairman mentioned, was the delay in granting reentry permits to Europeans on home leave, who thus had no guarantee that they would be permitted to return to their jobs. In the company's case, there was anxiety over the non-arrival of the reentry permit for the manager, now on leave.

Germany

Foam Cutting Device

A heated wire has been the usual means employed for cutting foam rubber and similar materials, since the nature of the material slows up work if sawing is resorted to and, moreover, saw cut edges are apt to be uneven.

A German firm has solved the problem by a recently patented system involving two saw blades acting in opposite directions, which is said to work easily and rapidly and to insure smooth cut surfaces. The saw, driven by a 150-watt motor, makes between 2,500 and 3,100 strokes a minute. The base plate of the instrument can be unscrewed to permit cutting of bevel edges, holes, and rounded corners. The tool, which weighs only about 3¾ pounds, is claimed to be suitable for shops making upholstery for furniture and automobiles, repair shops, and other operators using foam rubber.

Plastics Meeting Planned

The Seventh German Plastics Convention will take place April 10-11, 1957, in Bad Pyrmont, it is announced by the organizers. The Working Association of the German Plastics Industry and its member societies: Federation of the Plastics Processing Industry; Society of the Plastics Producing Industry & Allied Fields; Rubber & Plastics Division of the Society of German Chemists; Plastics Section of the German Engineers Association; and the Plastics Section of the German Standards Committee.

The last convention of this kind was held in 1954, in Stuttgart. German and foreign experts are to speak on the properties, production, processing, application, and testing of plastics. There are to be four morning lectures to be given in plenary assemblies, as follows: "Nuclear Energy in Its Economic and General Significance," W. Gerlach, Munich; "Petrochemistry and the Plastics Industry," Karl Winnacker; "Automation in the Processing of Plastics," Dr. Dolezalek, Stuttgart; and "Controlled Polymerization Through High Energy Irradiation," M. M. Magat, Paris, France.

Each afternoon three special sessions will be held on the following subjects; physics, chemistry, and standardization; molding and injection molding plant; special problems of the technology of molding and injection molding; extrusion and other methods of processing thermoplastics; cementing plastics and other bonding methods; recent methods in plastics processing.

Peru

Rubber Research Pays Off

During World War II the United States encouraged and cooperated with several Latin American countries in setting up projects aiming at improving and increasing local production of natural rubber. One of these projects was started in Peru, at the Tingo Maria Agricultural Experiment Station, some 335 miles from Lima.

The Tingo Maria Station now has about 200,000 rubber trees, including nursery plants as well as mature trees, and work has been proceeding on the development of clones that combine high yields with resistance to the South American leaf disease, the great killer of *Hevea brasiliensis*. Progress in this direction has reached the stage where hybrid clones, combining high-yield capacity and disease resistance, are beginning to replace the three-component tree first developed and consisting of a high-yielding Far Eastern clone on a seedling stock and itself top-budded with disease-resistant Brazilian material. Ultimately it is hoped to establish isolated gardens where certified disease-resistant clonal seed will be produced.

As a result of work at the Tingo Maria Station, about 20 rubber growers have meantime settled in the area and have planted high-yielding material; the largest undertaking has 16,000 trees. Some of the planters are already tapping their trees and are thus producing the first rubber from selected budgrafts in Peru. A government agency, The Agricultural Development Bank of Peru, is reportedly planning to finance rubber planting on a ten-year basis, starting this year. It is hoped thereby to encourage further planting in this area and other suitable areas as well as to draw additional settlers, an expectation which is likely to be fulfilled, judging by the fact that Tingo Maria Station already has a backlog of requests for over 250,000 trees

Nigeria

Dunlop Nigerian Plantation Co., Ltd., formed to exploit Dunlop's £3,500,000 rubber project in eastern Nigeria, has already begun clearing and planting on the 20,000 acres of land recently acquired. The company intends to specialize in concentrated latex for export.

(Continued on page 784)

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AA										X	X	X
AF					X		X		X			
AO or AO-X					X	X	X		X			
AR or AR-F			X		X							
BF or BG-X	X	X	X		X	X	X					
BGM or BGM-X	X	X		X		X						
CY					X				X			
DJ	X	X	X				X		X			
DL							X		X			
H			X		X			X	X	X	X	
LD	X	X	X	X	X	X		X				
ND or ND-X	X	X	X	X	X	X	X	X	X	X	X	
O	X	X	X	X		X	X		X	X	X	X
OS or OS-X	X	X	X	X			X					

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ALAMASK has no effect on processing characteristics or rate of cure... the only noticeable effect you will detect will be the upward trend of your sales curve!

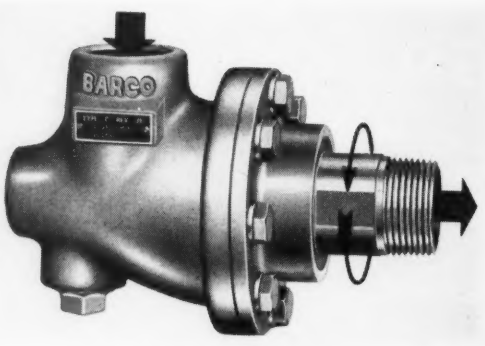
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NEW EQUIPMENT



Barco Type C joint

Compact Rotary Joint

A compact rotary joint suitable for use on steam, air, water, oil, gas, or alternating hot and cold service has been announced by Barco Mfg. Co., Barrington, Ill. Designated as Type C, the new joint is said to have been designed to simplify selection specifications by being almost universally suitable for pressures from 0 to 200 psi., steam, or to 400 psi., hydraulic; for temperatures to 450° F., or special to 500° F.; and for any ordinary rotating speed. The joint is also suitable for either single-flow or two-way syphon flow installation. Eight standard sizes are available, from ½-inch to three inches.

Type C joints, according to Barco, are characterized by low starting and running torque, even at high pressures, making power requirements low. The bearings and seal are self-lubricating, and the seal is self-adjusting for wear, eliminating the need of periodic take-up on packing or stuffing box.

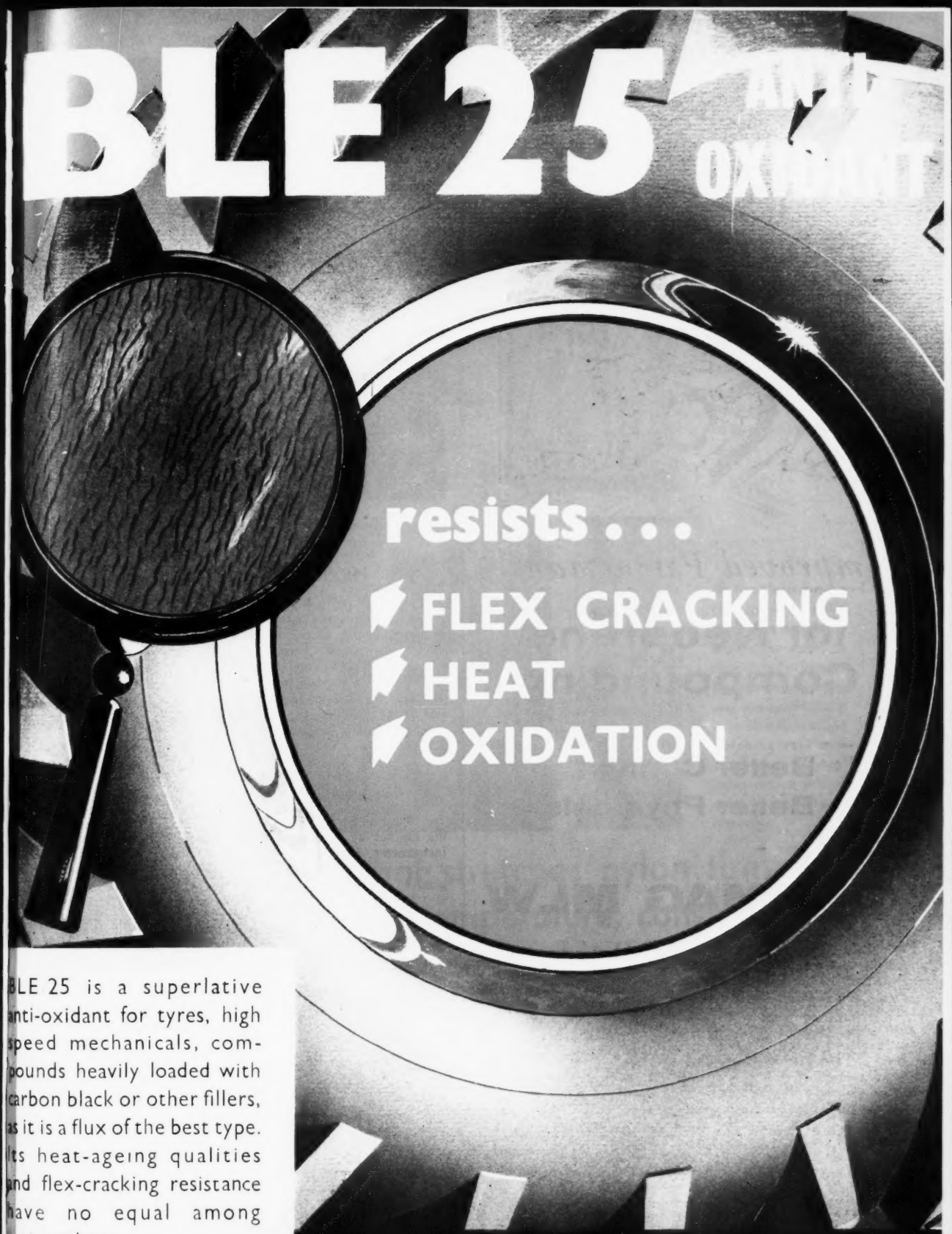
Expand/Aligner for Open-Weave Goods

A device for providing automatic edge, width, and centering control in the web processing of tire cord fabrics and similar open-weave goods has been introduced by C. A. Litzler Co., Inc., Cleveland, O. Called Expand/Aligner, the unit automatically spreads the fabric to counteract shrinkage, respaces selvage cords to eliminate crowding, correct misalignment of either or both fabric edges to prevent damaged selvages and ragged windup, and removes wrinkles.

The unit's spreading action is based, according to the company, on the principle of the bowed axis roll, in which a curved-axis, rotating rubber roll offers a concave surface to the incoming fabric to spread warp cords. This basic principle has been refined in the new unit by provision of a discontinuous expander roll axle having a flexible center section so that either end may be bowed independently.

Individual thrustor motors move the roll's axle ends and respond to prepositioned gaging heads which sense the selvage positions of the departing fabric at either edge. Should either edge of the web tend to move from gage in either direction, the affected gage instantly actuates the appropriate thrustor motor to readjust roll curvature for the necessary correction.

The Expand/Aligner is said to be particularly useful with storage accumulators, before dipping or saturating operations, after tension drying, and before calendering and windup. For tire cord fabrics, the bowed expander roll has a flat center section; while for marquisettes, gauzes, crinolines, tulles, nettings, and sheetings a radial roll is provided. The unit works in a tension range of from 50 to 300 pounds over a speed range of from five to 100 yards per minute.



BLE 25 is a superlative anti-oxidant for tyres, high speed mechanicals, compounds heavily loaded with carbon black or other fillers, as it is a flux of the best type. Its heat-ageing qualities and flex-cracking resistance have no equal among anti-oxidants.

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Scott Testers LGH Metal "Heatbath"

1000° F. Elastomer Tester

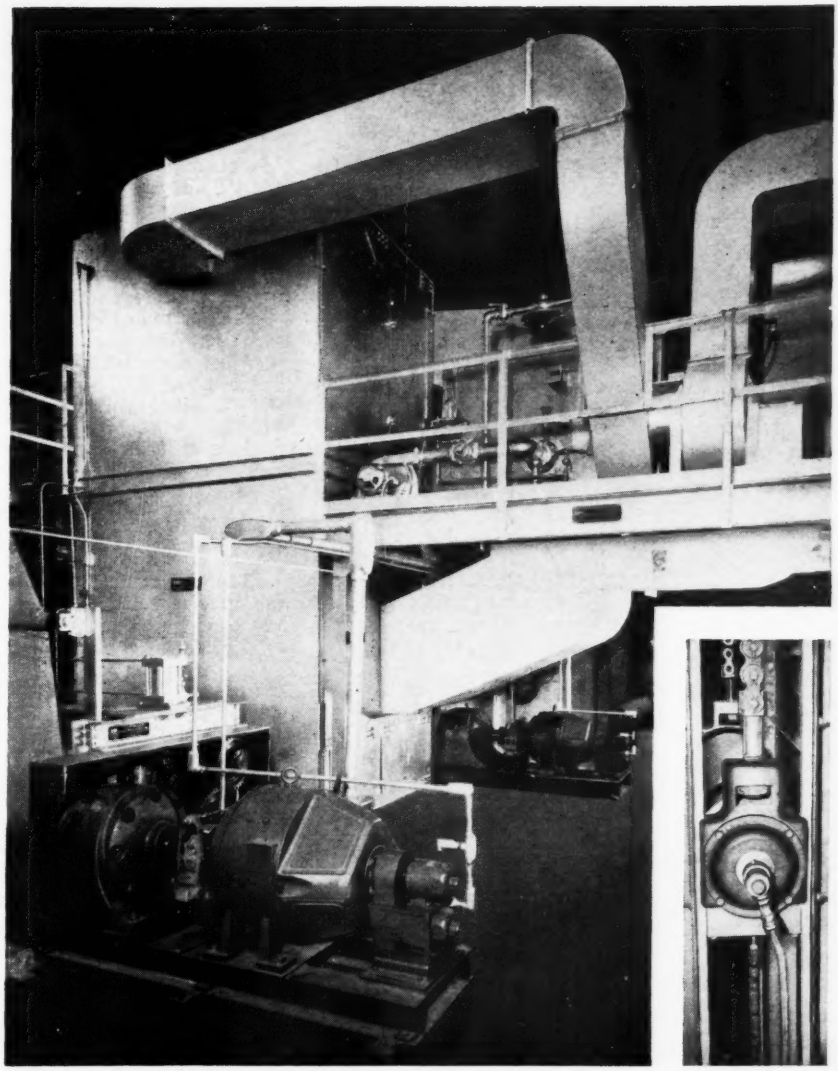
A tester for aging elastomers at temperatures up to 1000° F., such as rubbers and plastics used in jet engines, gas turbines, and in atomic energy plants, has been introduced by Scott Testers, Inc., Providence, R. I. Designated Model LGH Metal "Heatbath," it has 28 individual compartments in a stainless-steel block holding "Vycor" test tubes in which the contents are sealed. Temperatures are provided by 12,000-watt immersion heaters mounted around the block, with ample area of insulation adjacent to the exterior stainless-steel shell. Suitable controls are integral.

Small Beckman pH Meter

A battery-operated, pocket-size pH meter has been placed on the market by the scientific instruments division of Beckman Instruments, Inc., Fullerton, Calif. Called "Pocket pH" meter, it uses a single electrode that combines both the reference and glass electrodes and has a range from 2 to 12 pH. The device also has a so-called memory dial for use in standardizing.



"Pocket pH" meter



Within the first day of startup, full width nylon tire cord processed in this 30-yard-per-minute, 14,000-pound-tension **IOI** Rollevator® Oven*, was made into aircraft tires meeting all qualification tests.

The Rollevator® roll automatically moves up and down within the oven, in direct relation to line speeds. Thus, at *any line speed, heat-exposure* time of the nylon is held *constant* at a constant temperature setting and at constant tension.

Rollevator® Oven* hot stretches nylon tire cord at constant optimum temperature, constant time and constant tension, at variable line speeds

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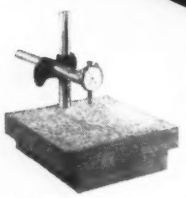
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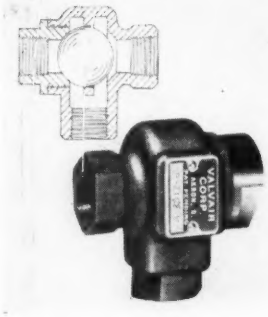
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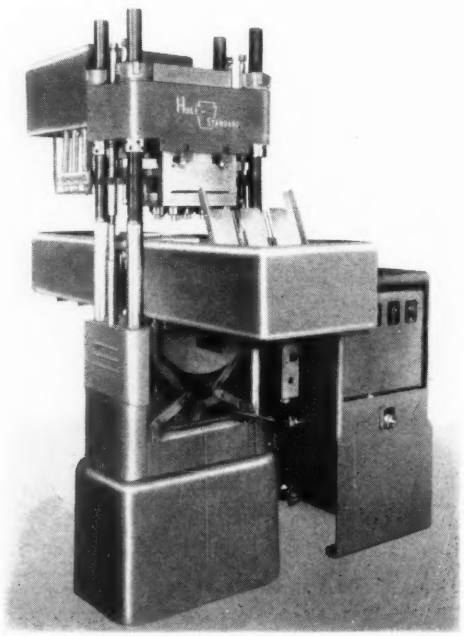
Directional Hycar/Bronze Valve



Valvair directional valve

A directional valve providing instant switch-over from automatic to manual control of diaphragm-operated valves, cylinders, and similar devices has been announced by Valvair Corp., Akron, O. The new valve consists of a captive Hycar ball which shuttles between two seats in the Navy M bronze valve body. When pressure is applied to one port, the ball shifts to and seals the opposite port. The valve is installed as a tee in the inlet lines, providing manual take-over from automatic control or control from two different sources. It can also be used to prevent intermixing of supply when two gases or liquids are being delivered alternately to a tank or container. The valve can be substituted for a dual top valve, the Valvair company further reports.

Suitable for use with air, oil, water, or media compatible with Hycar and bronze, the directional valve is available with ¼ and ⅜ N.P.T. ports. Net open area between seat and ball is equal to the transverse area of ⅜ standard pipe.



Hull-Standard Model 450-B

Compression Plastics Molding Presses

A new line of fully automatic, high-speed compression plastics molding presses is being manufactured by Hull-Standard Corp., Abington, Pa. Among the features of the presses are an all-electric drive, safety interlock system, and a sequence automatic cycle control. The complete dry cycle time is 12 seconds, not including the "slow close" adjustment, which is said to give a range of closing speeds to meet the plasticizing time requirements of various materials.

A 75-ton Model 450-B press has a closing speed at 2.9 seconds, opening speed at 2.7 seconds, a die area of 18 by 18¾ inches, and a platen stroke of seven inches. The hydraulic toggle action with its high-speed circuit requires a 3-hp. motor and provides minimum opening and closing time, according to the manufacturer.

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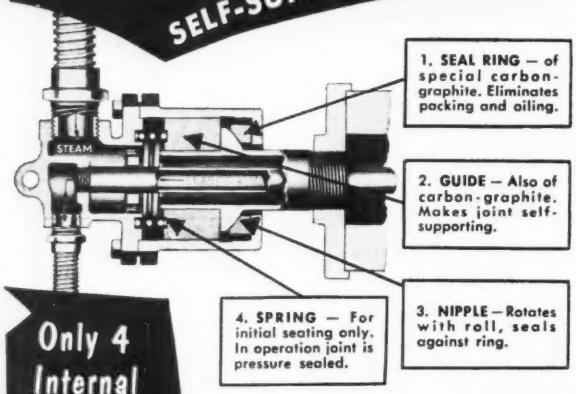
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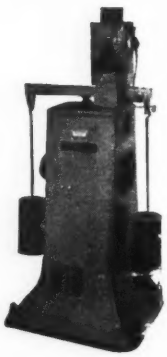
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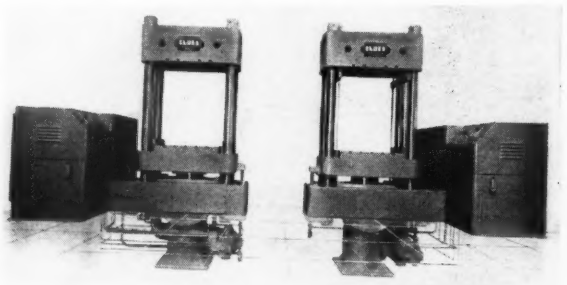
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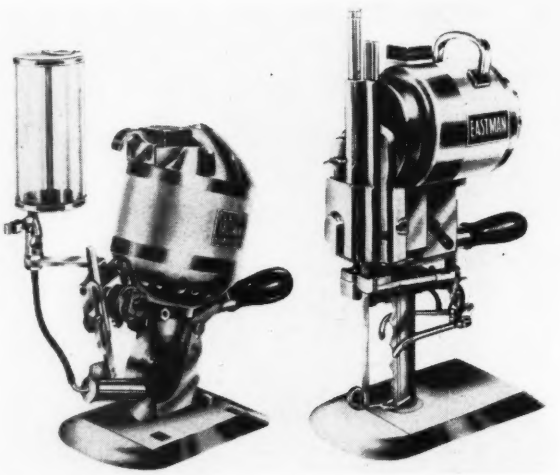
Dual 300-Ton Hydraulic Molding Presses

Two new 300-ton hydraulic compression presses, designed to make a compact installation for one-man operation, have been introduced by Elmes Engineering Division of American Steel Foundries, Cincinnati, O. Both presses are four-column moving-up types and are identical except that one is equipped with left-hand and one with right-hand control and top knock-outs. The hydraulic and electrical components and the piping of each press are encased in an individual metal cabinet which keeps out flash and excess material. The control panel of each unit is available to the operator while standing.

Specifications of each press have been reported as follows: die space, 36 inches L-R, 30 inches F-B; opening between platen and tophead, 44 inches; main ram stroke, 18 inches; operating pressure 2,640 psi.; operating speeds in inches per minute, 309 for advance, 15 for press, and 131 for return.



Left-hand and right-hand Elmes 300-ton presses



Plastic-Master Lightning *(left)* and Blue Streak cutters

Eastman Cutting Machines

Cutting machines for sheet rubber, rubber-coated or rubberized fabrics, plastic sheeting, laminated materials, and other products are being made available by Eastman Machine Co., Buffalo, N. Y. The machines, of different motor speeds, sizes, and various types of knives, are said to eliminate such problems as the fusing of cut edges due to the low melting point of some materials and the adhesion of chemicals to the cutting knife.

Called Plastic-Master, the cutting machines are available in the Blue Streak and Lightning lines. The Blue Streak line has a wave-edged knife that is said to reduce the cutting edge of a knife by some 80%, thus minimizing heat and friction and eliminating fusing of materials. The Lightning line has a round knife and is said to feature such improvements as permanently lubricated and sealed motor-bearings, a device that locks out lint and dust from the gears, a plow that keeps threads and ravelings from getting behind the knife, a dirtproof enclosure around the automatic starter, a side guard that facilitates knife replacement, and a smoothly operating sharpener.

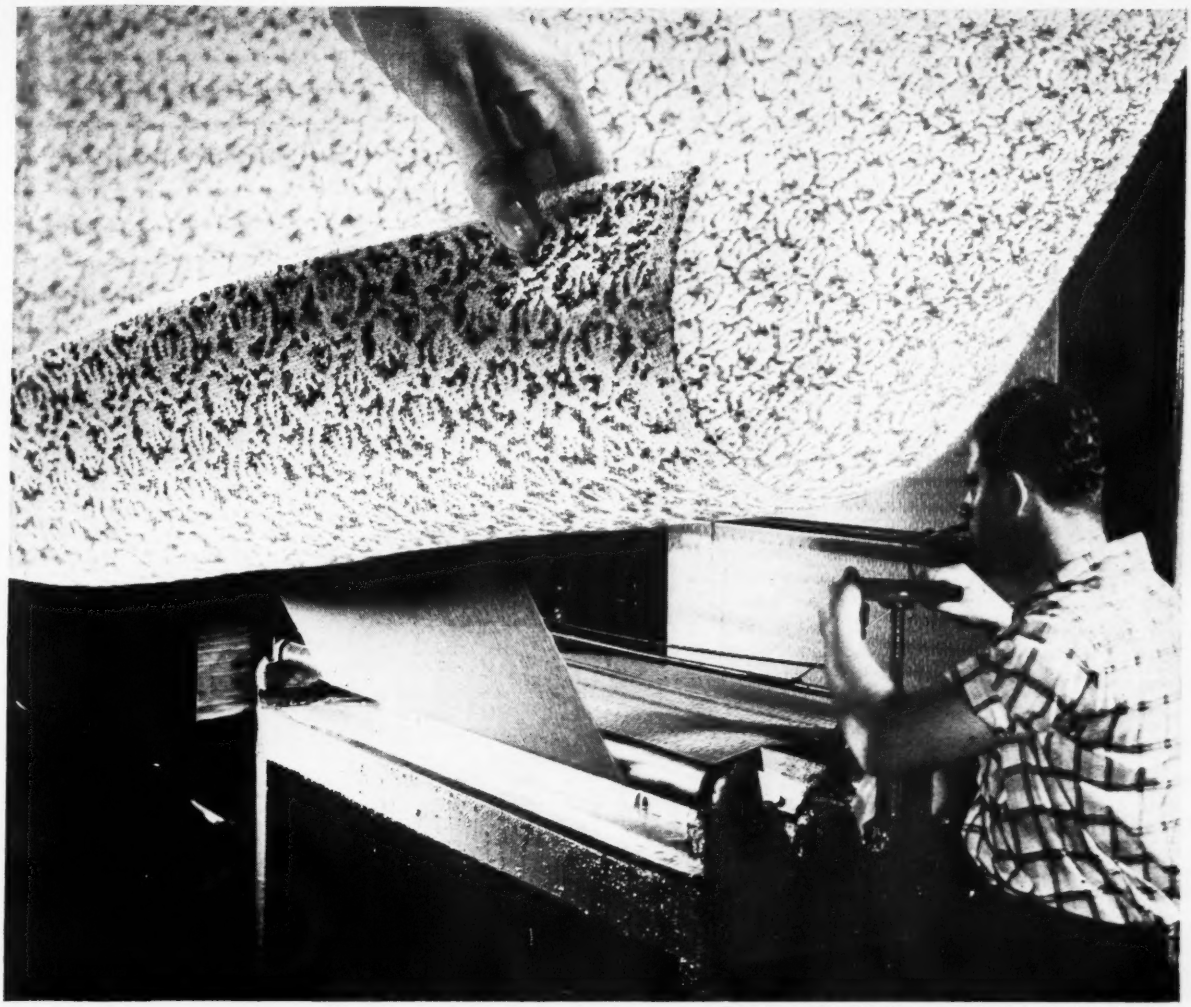


Photo courtesy Burlington Decorative Fabrics, Burlington Industries, Inc.

New way to back a winner

Textile manufacturers have looked long and hard for a means of improving the performance of fabrics for upholstery, drapes, handbags and footwear. Many types of backing were tried, but most of these presented new problems—in reduced flexibility and resilience, high cost, objectionable odor, poor adhesion or lack of permanence.

Finally, one industry leader tried a coating based on PLIOLITE LATEX. Barely visible, this lightweight, odorless backing "muscles" fabrics in every direction. It helps them retain their shape, even after severe stretching—and reduces wrinkling. It also improves body and drape, with increased resistance to raveling, tearing or snagging. *And it's permanent!*

If you are interested in light-colored latices for compounding customer-winning backings, sizes, saturants or finishes for all types of fabrics, it will pay you to know more about PLIOLITE LATEX. Learn, too, about the other uses for this versatile latex and other resin and rubber latices produced by Goodyear. You can, just by writing for details plus the *Tech Book Bulletins* to:

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NEW MATERIALS

Paraflint High-Melting Synthetic Wax

What is said to be an exceptionally hard, high-melting-point hydrocarbon wax useful for a variety of applications, including rubber and plastic processing, is being distributed in the United States and Canada by Moore & Munger, New York, N. Y. Called Paraflint, it is being manufactured by South African Coal, Oil & Gas Co. Synthesized from low-grade coal by the Fischer-Tropsch process, the white wax is a mixture of saturated, straight-chain paraffin hydrocarbons, having an average molecular weight of about 750, corresponding to approximately 50 to 55 carbon atoms, making it similar in molecular structure to the costlier conventional paraffin waxes derived from petroleum. It differs from conventional paraffin waxes in its high-temperature properties and crystal structure; the crystal size is much finer and more like petroleum microcrystalline waxes.

Suggested uses of Paraflint in rubber and plastic processing are as a detackifier, lubricant, hardening or stiffening agent, and as a finishing aid to improve gloss and provide a smoother surface. When compounded with some plastics, moisture vapor transmission characteristics of these plastics are said to be improved. The electrical properties of Paraflint also make the wax suitable for use in electrical potting and insulating compounds, the company adds.

Some reported physical properties of Paraflint are as follows:

Specific gravity @ 77° F.	0.93
Melting point	214° F.
Needle penetration @ 77° F.	1.0
Viscosity @ 250° F., centipoises	9.5

Essentially odorless, the new wax has an oil content less than 1.0% and an ash content less than 0.01%. There are no acid, saponification, or bromine numbers.

Discoloration Resisting Chemigum 247

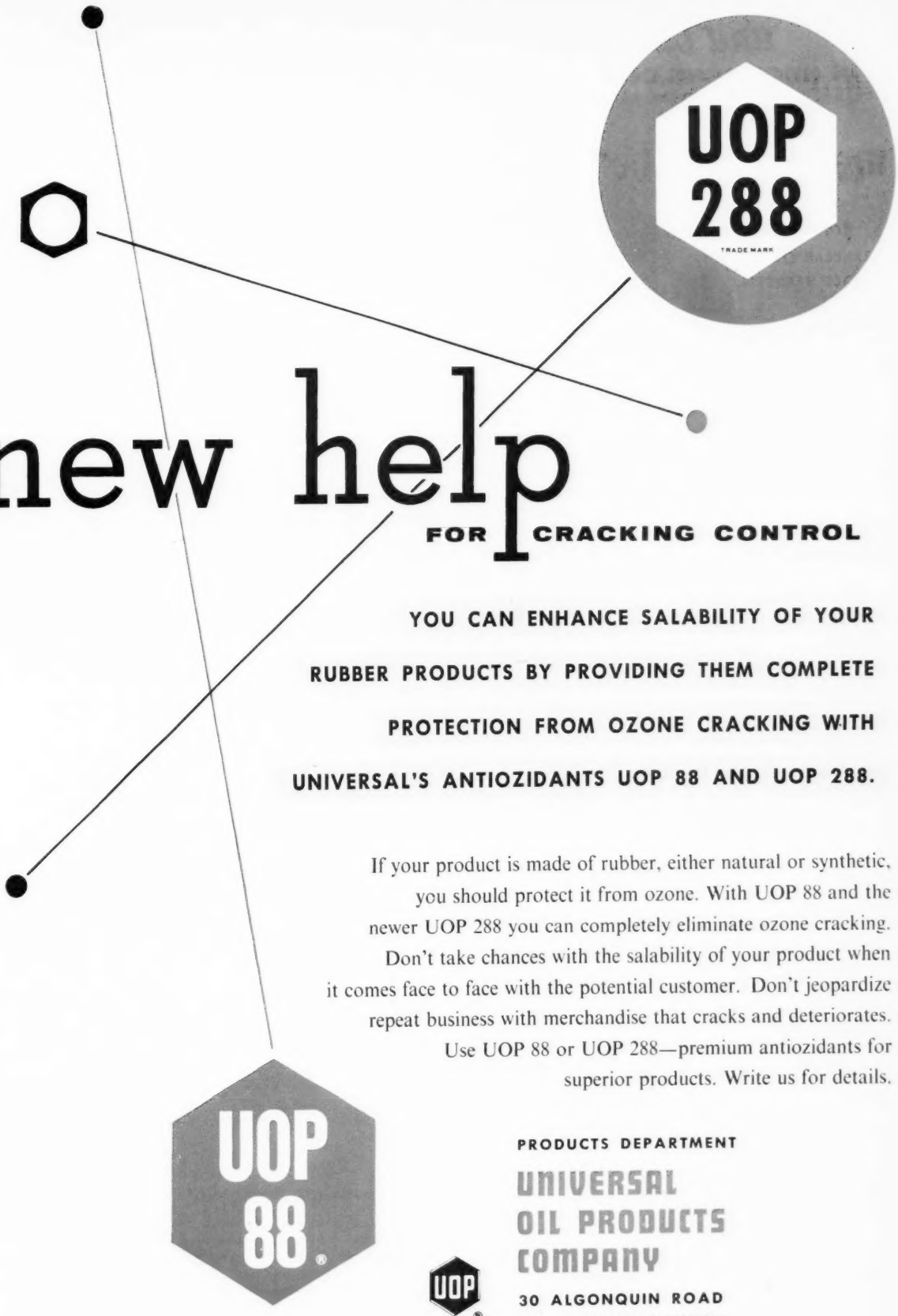
A medium acrylonitrile latex said to give improved resistance to discoloration on exposure to light or heat has been introduced by The Goodyear Tire & Rubber Co., chemical division, Akron, O. Called Chemigum 247, it has an emulsification system which imparts excellent mechanical and ion stability, according to the company. The latex does not show the extreme sensitivity to copper and metal ions that is characteristic of natural rubber and some SBR latices. Suggested applications are in textile inks, nonwoven fabrics, textile backcoatings and sizings, leather finishes, pigmented paper coatings, and carpet backings.

Conventional rubber curing systems can be used with Chemigum 247 when additional tensile strength or solvent resistance is required. Water soluble thermosetting resins also are compatible and can be used to give increased adhesion and solvent resistance.

The new latex allows increased latitude in processing since its color stability on prolonged heating at elevated temperatures is reported as outstanding. Unpigmented films show only a slight discoloration after 16 hours at 250° F.

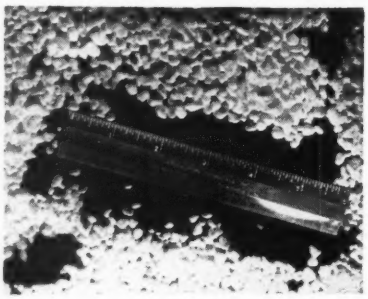
Some typical reported properties of Chemigum Latex 247 are:

Type	butadiene/acrylonitrile
Monomer ratio	67/33
Total solids, %	42 5
Stabilizer	synthetic anionic
Antioxidant	non-staining
pH	9.0
Average particle size, Angstroms	2,000
Specific gravity of latex	0.98
Solids, lbs./gal.	3.5
Latex, lbs./gal.	8.2
Brookfield viscosity, cps.	20
Surface tension, dynes/cm.	32


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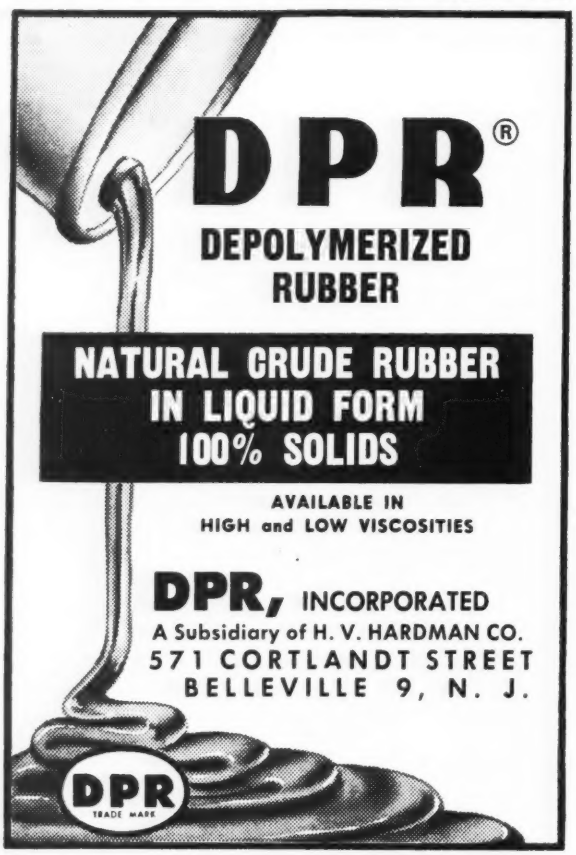
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Chemlok Rubber-to-Metal Adhesives

A one-coat adhesive for the bonding of uncured natural and synthetic rubbers to a variety of metals and rigid plastics, together with an accompanying primer to give the bond formed during the curing of the elastomer greater environmental resistance, has been introduced by Lord Mfg. Co., special products division, Erie, Pa. Called Chemlok 220, the adhesive is a black, free-flowing liquid containing a mixture of resins and fillers dispersed in an aromatic-type solvent. Chemlok 201, the primer, is a black, opaque, free-flowing liquid containing a mixture of various resins and fillers dispersed in a ketone-type solvent.

According to the company, the degree of adhesion obtained with one coat of Chemlok 220 usually exceeds that obtained with conventional two-coat adhesive systems, and the degree of environmental resistance is comparable. Metals with which the adhesive may be used are listed as carbon or alloy steel, stainless steel, copper or copper alloys, brass, aluminum or aluminum alloys, magnesium, die casting alloys, and plated metals.

Technical Bulletin 2001 describing in detail the Chemlok bonding system is available from the company on request.

Dow Corning 2106 Laminating Resin

A silicone low-pressure laminating resin said to be stronger and to cure faster than other silicone laminating resins has been announced by Dow Corning Corp., Midland, Mich. Called Dow Corning 2106 Resin, it is reported to be easy to fabricate, lightweight and to have low thermal conductivity; it can be used wherever resistance is needed to heat above the range of conventional laminates. Silicone-glass laminates withstand several hundred hours of exposure at 700° F. or a few hours at 1,000° F., according to the company. For radomes and associated electrical components, 2106 Resin is said to be especially useful. It is transparent to radio waves in the range of 10^{10} cycles per second even after heat aging and exposure to humidity.

Light straw in color and with a 60% solids content, Dow Corning 2106 Resin has a viscosity at 25° C. of 25 centipoises and a specific gravity at 25° C. of 1.08. Gel time at 480° F. is 5-10 minutes. Toluene is a suitable thinner for the resin.

Ethazate[1] as 50% Slurry

A 50% slurry of its Ethazate (zinc diethyl dithiocarbamate) accelerator for use in natural and synthetic rubber latex compounds is being marketed by Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn. Called Ethazate 50-D, it is a fine particle-size dispersion of Ethazate in water which may be added directly, without further dilution and with simple stirring. Ethazate is said to have fast, low-temperature curing characteristics when used alone, but is most commonly used in combination with zinc mercaptobenzothiazole (O-X-A-F)[1] to give a broader and more generally applicable curing range.

Some physical properties of Ethazate 50-D have been reported as follows:

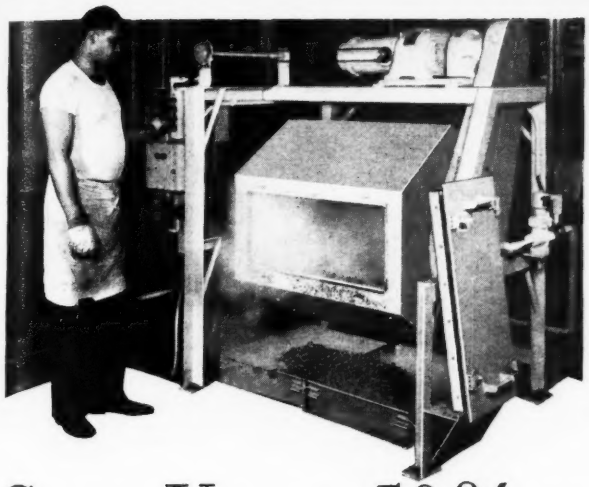
Surface tension, dynes/cm.	59.7
Electrolyte content, grains NaCl per gal. (approx.)	320
Non-active solids, %, max.	4.0
Viscosity, max.	1,000
pH	8.5-11.0
Weight per gal., lbs.	10

[1]Naugatuck Chemical Division, United States Rubber Co., trade mark.

Dimethylaminoethyl Methacrylate Monomer

Dimethylaminoethyl methacrylate monomer is being made available in pilot-plant quantities by Rohm & Haas Co., Philadelphia, Pa. The monomer can be polymerized, quaternized, and copolymerized with methacrylic acid, methacrylate esters, acrylonitrile, and, theoretically, with butadiene and vinyl acetate.

(Continued on page 780)



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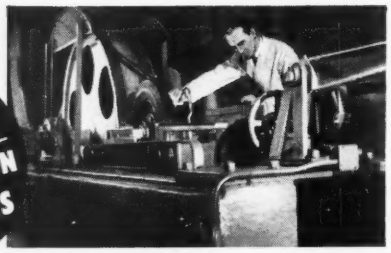
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BOOK REVIEWS

"Aging and Weathering of Rubber." By J. M. Buist. Institution of the Rubber Industry monograph, 4 Kensington Palace Gardens, London, W.8, England. Published by W. Heffer & Sons, Ltd., Cambridge, England. Cloth, 6 by 9 inches. 148 pages. Price 25s. net.

In this second of a series of monographs sponsored by the council of the Institution of the Rubber Industry, the author has made a thorough search of information, both published and unpublished, pertaining to the subject of the aging and weathering of rubber. Because this phase of rubber technology is older abroad than in the United States, more information is given in the field of natural rubber than in the field of synthetic elastomers.

The information is presented in a concise, readable style and with an understanding that "the rubber industry . . . has established its processes and techniques by empirical methods without necessarily being able to explain fully the underlying scientific principles. This is certainly true in the fields of aging and weathering." As with theories of vulcanization, there also seems to be an abundance of theories as to what are the basic causes for deterioration due to aging.

With that warning to the reader for the judicious use of seasoning to what is written in the monograph, the author proceeds to introduce the problems involved in dealing with his subject. It is indicated that although ozone and oxygen are the prime factors producing degradation, their action may be triggered by other influences. The problem of aging and weathering, which is admittedly a chemical one, is measured physically owing to the present state of ignorance pertaining to the chemical structure of raw rubber and even vulcanized rubber.

The oxidation of unvulcanized rubber is discussed on the basis of the oxidation of olefins, after which a discussion of vulcanized rubber logically follows. Shelf aging, metallic poisoning, heat aging, light aging, flex cracking, and atmospheric cracking are covered in sequence. Attention is focused on the fact that the form in which the metal contaminant is present in the rubber compound has a very definite bearing on the tolerance the compound may have for it. There is indicated a correlation between flex cracking and ozone resistance, and recognition is given to the fact that ozone is only one of the components of "weather" having a deleterious effect on rubber.

The several forms of accelerated aging tests, such as the oven, oxygen bomb, air bomb, and ozone tests, used to predict the life of rubber compounds, are surveyed. In addition to the conventional types of accelerated aging, humidity and steam tests, oxygen absorption, stress relaxation, and attack by micro-organisms are discussed as means for measuring degradation. The use of individual containers for accelerated air oven and oxygen bomb aging is also dealt with.

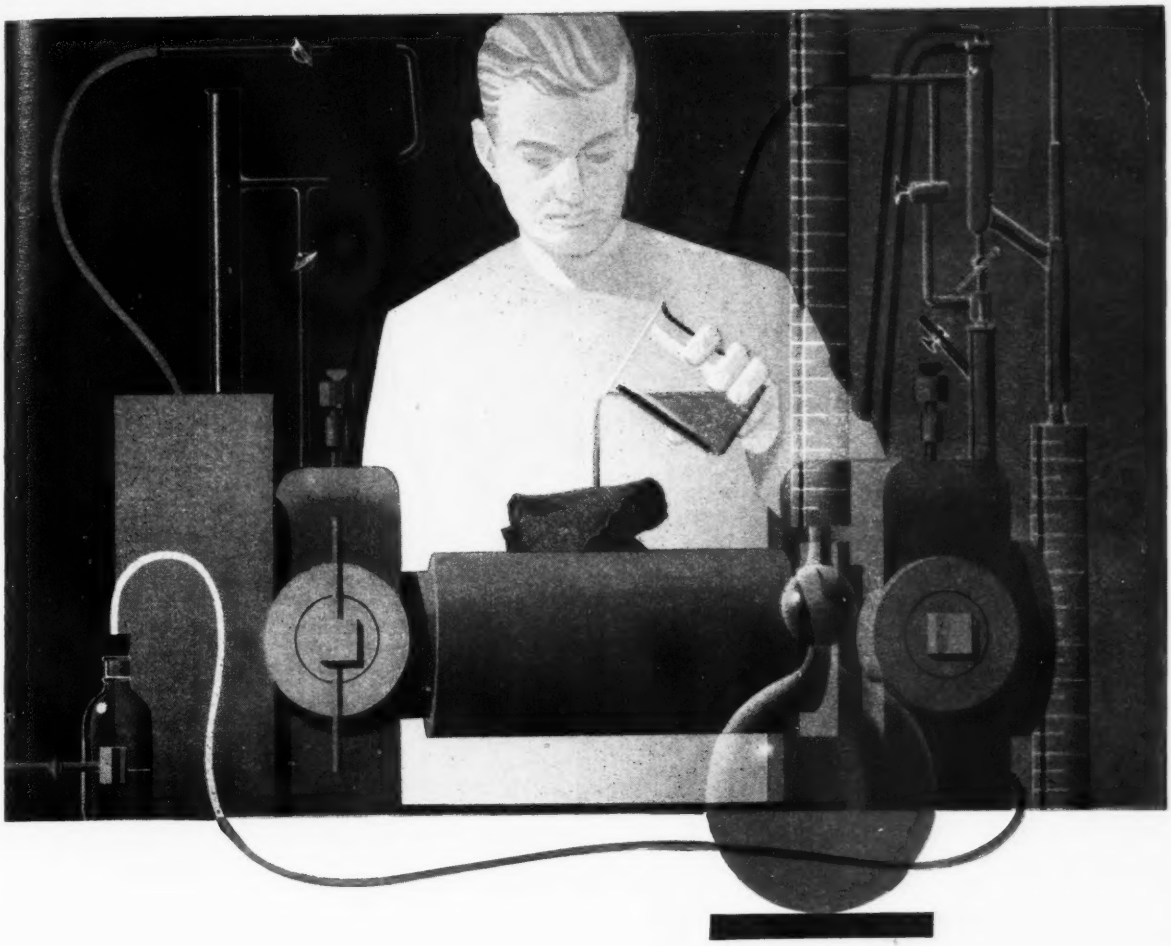
A final chapter is devoted to commercial antioxidants and includes a classification and description of the 125 antioxidants at present offered commercially throughout the world.

G. C. MAASSEN

"Chemical Process Economics in Practice." Edited by J. James Hur. Reinhold Publishing Corp., New York, N. Y. Cloth cover, 5 by 7½ inches, 120 pages. Price, $3.95.

This is a compilation of the seven papers presented at the fourth "Experience in Industry" Symposium, Philadelphia, Pa., April, 1956, under the joint auspices of the Philadelphia-Wilmington Section of the American Institute of Chemical Engineers and the School of Chemical Engineering, University of Pennsylvania. Taken together, the papers represent a practical instruction book on how the engineer and the economist profitably employ each other's talents and work together creatively.

The titles of the papers and their authors are the following:



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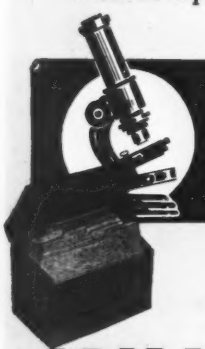
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"Why Accounting?" H. P. Kulp, Sun Oil Co.; "Plant Investment." L. C. Knox, Catalytic Construction Co.; "Cost of Services." A. E. Lawrence, E. I. du Pont de Nemours & Co., Inc.; "Plant Operating Costs." H. R. Moody, Rohm & Haas Co.; "What Price the Chemical Product?" F. Faxon Ogden, Atlas Powder Co.; "Economic Analysis." J. C. Martin, Atlantic Refining Co.; and "Financing the Plant." Will J. Price, Stone & Webster Securities Corp., and Karl Finsterbusch, Stone & Webster Engineering Corp.

"Sodium: Its Manufacture, Properties and Uses." Marshall Sittig. Reinhold Publishing Corp., New York, N. Y. Hard cover, 6 by 9 inches, 529 pages. Price, $12.50.

This volume combines all the information currently important in the manufacture, handling, and use of sodium, with a critical coverage of its physical, chemical, and thermodynamic properties. Separate chapters are devoted to the historical background of the element, the manufacture of metallic sodium, solubility and alloy formation, handling of metallic sodium, uses, the inorganic reactions of sodium, the use of sodium in organic reactions, and the analytical chemistry of sodium. A chapter on the physical and thermodynamic properties of sodium by George Wm. Thomson and Edward Garelis is also included.

More than 150 flow sheets, line drawings, and photographs of equipment and actual sodium handling operations illustrate the text. Some 2,000 references provide access to the body of published periodical and patent literature on sodium. One of the American Chemical Society's Series of Chemical Monographs. Mr. Sittig's book is uncompromising in its scope and technical content.

NEW PUBLICATIONS

"Alco." Alco Oil & Chemical Corp., Philadelphia, Pa. This illustrated booklet describes the company's products, such as latex compounds, rubber compounding materials, wetting agents, ultra-accelerators, stabilizers, and thickeners.

"G-E Molding Materials and Resins." CDC-322. General Electric Co., chemical materials department, Pittsfield, Mass. 12 pages. The company's phenolic and rubber phenolic molding materials and resins are described in this illustrated brochure.

"Hycar Technical Newsletter." Vol. V, No. 5, October, 1956. B. F. Goodrich Chemical Co., Cleveland, O. 8 pages. A strong, blister-resistant Hycar compound to make sleeves and diaphragms for regulators used in the oil and gas industries is discussed in this issue of the Newsletter. Recipes and post-cure test data are given.

"Technical Seminar on Synthetic Latex Polymers." The Goodyear Tire & Rubber Co., chemical division, Akron, O. 44 pages. This is a collection of papers given at two Goodyear seminars on synthetic latex polymers at Crown Zellerbach Corp., Camas, Wash., October, 1955, and at Georgia Institute of Technology, Atlanta, Ga., May, 1956. The papers were authored and presented by Goodyear executive, research, and sales personnel. The titles of the papers and their authors are: "The Synthetic Latex Industry," H. R. Thies; "Theoretical Consideration of Polymerization and Latex Characteristics," and "The Course of a Product Development," J. D. D'Ianni; "Properties of Latex Systems and Evaluation Procedures" and "The Influence of Latex Variants on Important Performance Characteristics," W. C. Smith; "Sources of Materials for Latex Manufacture," "The Production of Synthetic Latex," and "Types of Latex Commercially Available," R. S. Earhart and A. E. Polson; and "A Survey of Latex Applications and Potentials," E. W. Scott.

"Compounding Enjay Butyl for Electrical Applications." Enjay Co., Inc., New York, N. Y. 20 pages. Recipes for butyl in electrical applications are given in this section of the Enjay Butyl Manual. Compounding suggestions and test data are included.



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It's true that some molders of rubber products buy our Vulcosal* (Dow Salicylic Acid) without hesitation. Its dust-free quality speaks for itself.

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"Products Book." Allied Chemical & Dye Corp., Solvay Process Division, New York, N. Y. 56 pages. The entire line of Solvay alkalies and chemicals is described in this illustrated catalog. The products' uses, markets, physical and chemical properties, packaging and handling, and storage are discussed.

"Aceto Products List." Aceto Chemical Co., Inc., Flushing, N. Y. 4 pages. More than 200 of the company's fine chemicals, intermediates, and industrial chemicals for the rubber, plastics, textile, and other industries are listed in this folder.

"Fawick Standardized Press Application." Bulletin ML-172, Fawick Airflex Division, Fawick Corp., Cleveland, O. 13 pages. The company's line of package applications for modernization of presses and similar machinery with pneumatic clutch and brake is described and illustrated in this brochure. Specifications and prices are included.

"Fluid Agitation Handbook." Chemineer, Inc., Dayton, O. 46 pages. Price, $1.50. This handbook details theoretical and practical approaches to fluid mixing problems in the process industries. It outlines procedures for determining optimum mixing characteristics of fluids in relation to their physical properties. Methods are given for sealing-up a laboratory mixing operation to a production process. In addition, a new experimental agitator is described for use in the laboratory for bench-scale and pilot-plant mixing operations.

"Abrasive Wheel Net Price and Data Book." No. 6465. Manhattan Rubber Division, Raybestos-Manhattan, Inc., abrasive wheel department, Passaic, N. J. 36 pages. This publication lists rubber and resinoid bonded grinding wheels used by industry, giving sizes, shapes, types of grain available, and actual consumer net prices.

"Fabricated Parts and Components . . . Management Decision for Profit." National Vulcanized Fibre Co., Wilmington, Del. 12 pages. The advantages of sub-contracting with the company for fabricated parts made from vulcanized fiber, Phenolite laminated plastic, nylon, and combinations of these materials are considered in this illustrated brochure. A property and applications chart on these materials is included.

"Tenox." Eastman Chemical Products, Inc., Kingsport, Tenn. 4 pages. The properties, composition, and applications of the company's Tenox antioxidants for use in the manufacture of rubber latex and polyethylene, among other products, are itemized in this folder.

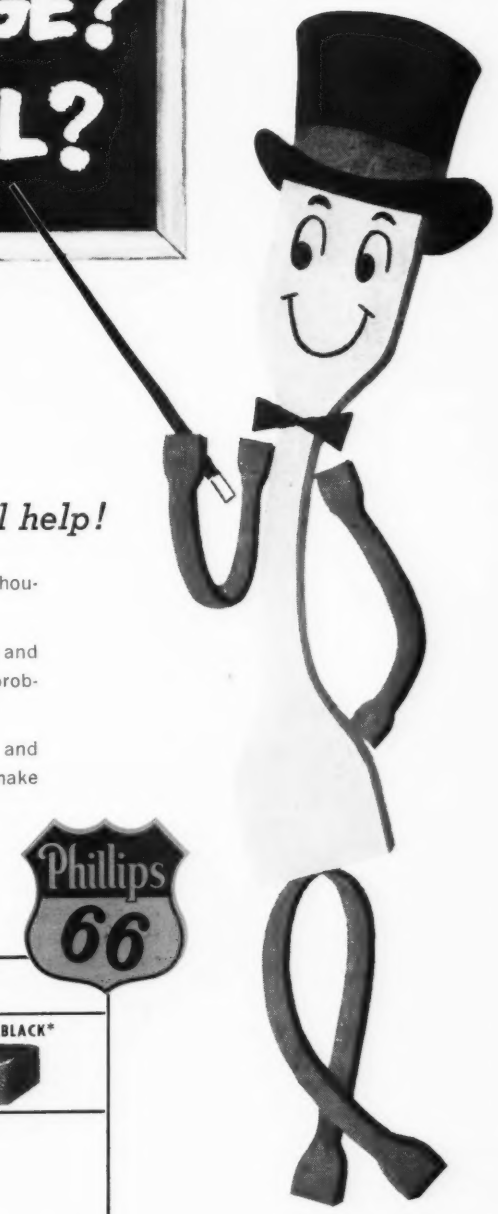
"Research and Development by Non-Profit Research Institutes and Commercial Laboratories, 1953." Superintendent of Documents, Washington, D. C. 86 pages. Price, 50¢. This report, prepared for the National Science Foundation by the Maxwell Research Center of Syracuse University, outlines the scientific research and development effort of all the known non-profit research institutes and a substantial sample of the commercial laboratories in the United States during 1953. About $92 million were spent in that year, and approximately 5,000 scientists and engineers were employed by the organizations. This study is part of a survey of the total research and development effort of the United States, undertaken by the National Science Foundation.

Publications of Union Carbide & Carbon Corp., New York, N. Y.:

"Products of Union Carbide & Carbon Corp." 12 pages. This is the 1957 listing of the products of UCC's divisions and subsidiaries, alphabetically arranged. Sales office addresses are included.

"W-96 Silicone Rubber Gum Stock." 28 pages. The compounding of the company's vinyl-containing methyl silicone gum is discussed in this technical data booklet. The typical properties and comparative specifications of W-96 with Hi-Sil X-303 and with Santocel CS, and the properties of W-96 compounds with furnace black fillers are reported along with other test data.

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Publications of Naugatuck Chemical Division of United States Rubber Co., Naugatuck, Conn.:

"Betanox Special." R. R. Barnhart. Compounding Research Report No. 39. 10 pages. The use of the company's non-staining amine type of antioxidant in natural rubber, neoprene, and SBR is discussed in this report. Recipes and test data are given. This antioxidant is non-staining by migration from vulcanized rubber to other materials by contact in contradistinction to discoloration of the rubber itself.

"Kralistic Extrusion." E. J. Trunk. Bulletin No. 1. 16 pages. Technical information on the proper equipment and methods for extruding Kralistic, a resin-rubber blend, is given in this illustrated booklet.

Publications of E. I. du Pont de Nemours & Co., Inc., elastomers division, Wilmington, Del.:

"The Zenites." A. L. Moran and E. J. Brislin. Report No. 56-7. 14 pages. The properties and use of the company's Zenite accelerators (active ingredient zinc salt of mercaptobenzothiazole) are discussed in this booklet. Recipes for natural rubber, SBR, and neoprene stocks employing Zenite are included, together with test data.

"Thermoflex A Flex Crack Resisting Antioxidant." A. L. Moran and E. J. Brislin. Report No. 56-8. 8 pages. Recommendations for the use of Thermoflex A, amine-type antioxidant, in natural rubber, SBR, and neoprene stocks for such products as tire treads, conveyor belts, shoe soles, and high-voltage cable jackets are given in this report. Recipes and post-cure test data are included.

"NBC." E. J. Brislin. Report No. 56-9. 8 pages. The use of the company's NBC to improve the weather resistance of SBR and nitrile stocks and the heat resistance of Hypalon 20 and neoprene stocks is discussed here. Recipes and post-cure test data are given. NBC is nickel dibutyl dithiocarbamate.

"Coatings of Hypalon 20 Synthetic Rubber." Irvan D. Roche. Report No. 56-10. 76 pages. Hypalon 20 surface coatings for steel, rubber, concrete, masonry, fabric, and wood are described in this report. Coating systems based on a dispersion of pigments and other ingredients in a vehicle of Hypalon 20 and solvents are said to yield films which are tough, elastic, and resilient, and resistant to sunlight, weather, ozone, abrasion, flexing, flame, water, and a variety of chemicals and solvents. Methods of preparing and applying these coatings are discussed, and test data reported.

Publications of the Office of Technical Services, United States Department of Commerce, Washington, D. C.:

"Preservation of Tires in Outdoor Storage." PB 121480. By W. J. Touhey, Rock Island Arsenal Laboratory, U. S. Army Ordnance Corps. 36 pages. Price, $1. Incorporation of chemical ozone inhibitors and wax into formulations during manufacture of rubber tires was recommended. Coatings of flexible ozone-resistant materials such as neoprene, vinyl, Thiokol polysulfide rubber, and other polymers were said to afford adequate protection, but underwent embrittlement, peeling, and rupture when the vehicle was moved. Tire covers were called impractical for the same reasons.

"Antiozonants in Oil-Extended and Plasticized GR-S Vulcanizates." PB 121501. By E. W. Bergstron, Rock Island Arsenal Laboratory, U. S. Army Ordnance Corps. 21 pages. Price, 75¢. Oil-extended and plasticized SBR vulcanizates were evaluated for resistance to ozone attack after the addition of antiozonants known to protect unplasticized vulcanizates. The antiozonants were found to be less effective in the oil-extended and plasticized compositions. Effectiveness decreased with the increase in oil content of the one compound. The antiozonants also afforded less protection in plasticized sulfurless cured SBR compounds than in those which were sulfur cured.

"Elastomeric Polyphosphates." PB 121391. 37 pages. Price, $1. Part 2 of this investigation by U. P. Strauss, Rutgers University, for Wright Air Development Center, discusses cross-linking of polyphosphate chain, attempted as part of a project to prepare an elastomer whose backbone is the polymetaphosphate chain. Molecular weights of crystallized potassium polyphosphate were shown to be as high as 3×10^6, or sufficient for use in elastomeric materials. A procedure for cross-linking of polyphosphates by fusion is explained. Another is described for the reduction of intermolecular forces by separating the chains as much as possible.

"Bibliography of the Material Damping Field." PB 121437. 105 pages. Price, $2.75. This bibliography, compiled by L. J. Demer, University of Minnesota, for Wright Air Development Center, is believed to be the most extensive ever compiled for the field of damping of materials and structures. It contains 900 entries, with abstracts provided for most references. A detailed classifications system is described.

"Development of Fluoro-Silicone Elastomers." PB 121394. 24 pages. Price, 75¢. Part 2 of this investigation by P. Tarrant and G. W. Dyckes, Peninsular Chemresearch, Inc., for Wright Air Development Center, relates the effect of various initiators or catalysts on the addition reaction involving a single olefin-silane system. Platinum supported on charcoal was found to give highest yields and allowed shorter reaction times and lower temperatures for the reaction. Compounds resulting from the addition of CF_2Br_2 and CF_2-BrCFClBr to vinyltrimethylsilane were made to undergo reactions involving the loss of halogen.

"Synthetic Rubber from Carbon-Fluorine Compounds." PB 121351. 67 pages. Price $1.75. Part 5 of this investigation by F. A. Bovey, Minnesota Mining & Mfg. Co., for Wright Air Development Center, discusses fluorine-containing elastomers such as FBA (1,1-dihydroperfluorobutyl acrylate) which were prepared and investigated for possible use in fuels, lubricants, and hydraulic fluids over the widest possible temperature range. One effective non-fluorinated plasticizer for poly-FBA was disclosed by experimentation. A new, economical type of alkoxy-alkyl acrylate was developed.

"Principles of Laboratory Temperature Control, Electronic Relays, Thermistor Operated Temperature Control." PB 121120. 55 pages. Price, $1.50. This three-part report of research into devices for laboratory temperature control discusses the principles of temperature control in the laboratory, two types of electronic relays which can be built in the laboratory, and a thermistor-operated controller which allows temperature to be set by a dial and controlled to $\pm 0.01°$ C. or better. The author is C. M. Proctor, who did the work for the Office of Naval Research.

"Development of Non-Destructive Tests for Structural Adhesive Bonds." PB 121495. 45 pages. Price, $1.25. The principles, construction, and operation of a device called the STUB-meter, which enables non-destructive evaluation of structural adhesive bonds by ultrasonic technique, now under development for the Air Force, are discussed in this publication. The device relies on the vibration behavior of a ferro-electric transducer, which indicates structural properties of adhesive bond specimens coupled to it.

"Vac-Trim." Vacuum Forming Corp., Port Washington, N. Y. 4 pages. The company's Vac-Trim machine that vacuum forms, drape and plug forms, and automatically trims thermoplastic sheet in one operation is described in this illustrated brochure.

Dimethylaminoethyl Methacrylate Monomer

(Continued from page 772)

Suggested applications for the monomer, based on those that have been described in the literature for homologous dialkyl-aminoethyl methacrylate or analogous products such as vinyl-pyridines, include the following: butadiene copolymers for improving adhesion between rubber and nylon or rayon tire cord; butadiene copolymers as oil-resistant synthetic rubber; stabilizer for chlorinated polymers; ion exchange resins and acid acceptors; copolymers with methacrylic acid as amphoteric thickening agents; cationic precipitating agents; and lubricating oils and fuel oil additives.

The following are some typical physical properties for the technical grade of the monomer:

% Nitrogen	8.9
Bromine no.	12.4
Alkaline neutralization no.	353
Saponification no.	355
Flash point, Tag. open cup	165° F.
Refractive index @ 20° C.	1.4394

A technical bulletin describing the reactions of the monomer and giving references to the literature is available from the company.

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MARKET REVIEWS

Natural Rubber

Prices on the natural rubber market during December 16-January 15 period plummeted to pre-Suez levels as gasoline rationing and cutbacks in auto production in Europe and faded optimism on auto sales here reduced the amount of tire and other rubber being consumed, depressing prices. The market started sliding as 1956 was coming to an end, with RSS #1 sellers' price, for example, declining 4¢ a pound in the first two weeks of 1957. The fall appeared to be continuing.

The resignation of Prime Minister Eden also contributed to the slump. So did the political troubles besetting Indonesia; rebellion there caused many Far Eastern producers to hold back cable offerings until developments clarified.

Barring unforeseen influences, natural rubber prices should strengthen by February 1 with the beginning of the seasonal pick-up in automotive production. Further clearance of the Suez Canal, improving the European gasoline situation, should also help stabilize prices.

Statistically, a total of 37,440 tons of rubber was traded on the New York Commodity Exchange during the December 16-January 15 period, mostly on the Rex Contract. The RSS #1 Contract expired on December 27. The Rubber Standard Contract, now almost completely ignored by consumers, accounted for only 260 tons of the total, all traded on January 15.

Week-end closing Commodity Exchange future prices for the Rex Contract follow:

REX CONTRACT

	Nov. 23	Dec. 21	Dec. 28	Jan. 4	Jan. 11
Nov. 1957	35.95	....	....	....	....
Jan.	35.80	36.70	37.45	36.80	33.65
Mar.	35.60	36.85	37.35	37.00	33.60
May	35.35	36.30	36.65	36.15	33.16
July	34.95	35.90	36.05	35.80	32.75
Sept.	34.50	35.50	35.45	35.30	32.30
Nov.	34.00	35.00	34.95	34.80	31.85
1958					
Jan.	....	....	34.50	34.45	34.30	31.40
Total weekly sales, tons	7,340	4,490	6,990	4,030	14,330

On the physical market, RSS #1 began the December 16-January 15 period at 36.88¢ a pound, according to Rubber Trade Association sellers' prices, rose to a period high of 37.63¢ on December 26, and fell to a low of 33.25¢ on January 15. Average December monthly RTA sellers' prices for representative grades were as follows: RSS #1, 36.86¢; RSS #3, 36.57¢; #3 Amber Blankets, 30.63¢; and Flat Bark, 24.03¢. There were 19 trading days during December. For the first half of January the #1 grade averaged 34.90¢ a pound. For the December 16-January 15 period, the #1 grade averaged 35.87¢.

NEW YORK PHYSICAL MARKET
WEEK-END CLOSING PRICES

	Nov. 23	Dec. 21	Dec. 28	Jan. 4	Jan. 11
RSS #1	35.75	36.50	37.38	36.75	33.63
2	35.50	36.38	37.25	36.50	33.38
3	35.38	36.25	37.13	36.38	33.13
Pale Crepe					
#1 Thick	45.75	45.25	45.00	44.88	41.50
Thin	44.75	44.25	45.00	43.88	40.50
#3 Amber Blankets	29.00	31.00	32.25	32.00	29.75
Thin Brown Crepe	28.25	29.38	32.00	31.75	29.25
Standard Flat Bark	23.50	23.75	24.38	24.25	22.75

Synthetic Rubber

Although the consumption of synthetic rubber in the United States during 1956 dropped to 877,094 long tons, according to estimates of The Rubber Manufacturers Association, Inc., as compared to the 894,899 long tons consumed in 1955, the 1956 ratio of synthetic to natural rose to 60.9%, as compared to the 1955 ratio of 58.5%, indicating the continuing strides of the industry. Production during 1956 amounted to 1,079,695 long tons, an increase of more than 100,000 long tons over 1955, when 970,468 long tons were produced in domestic plants.

The biggest statistical jump, however, was in exports. The RMA estimates that 159,026 long tons of synthetic rubber were sent abroad during 1956, compared to 93,290 long tons in 1955, a phenomenal increase of almost 71%. December exports were the highest on record at 21,780 long tons, of which 18,500 long tons were S-Types. This increase was caused by the Egyptian blockage of the Suez Canal.

Domestic demand for SBR is now at the 60,000-long-ton-level monthly. Exports of SBR are expected to decline in the early months of 1957 owing to gasoline rationing in Europe. Domestic capacity of SBR production is seen at about 80,000 long tons a month, but this may not be needed if foreign demand expectedly softens and U. S. consumption fails to take up the slack.

Butyl rubber production, consumption, and exports have been running at about 80% of capacity, but this figure is expected to rise. The announced plan of Petroleum Chemicals, Inc., to build a new 30,000-ton plant delineates the future market strength of this rubber.

Neoprene production, consumption, and exports parallel butyl, but increased capacity now available will permit another 2,000 long tons of consumption. Exports of neoprene during 1956 are estimated at 22,471 tons, compared to 18,098 long tons sent abroad the previous year.

Nitrile rubber also follows the butyl and neoprene trend, emphasizing the growing non-tire products growth, now amounting to 54% of total rubber goods sales.

Pressure to boost SBR prices continues to build up, according to industry observers, with raw material, labor, and production costs inching higher month by month and with some plants operating at less than 100% of capacity. Adding to the pressure is the rising costs involved in the more aggressive selling by competitive producers, together with climbing development and technical service expenses.

Latex

Activity in the natural rubber latex market tapered off considerably during the December 16-January 15 period, and observers agreed that there was little likelihood of a revival during the remainder of January and in early February unless prices fell sharply. Consumers were seen to have adequate stocks on hand in view of curtailed automotive production.

Reports from the synthetic latex market, sparse as usual, indicate that demand was somewhat off from last period's, but still higher than demand for natural latex.

Prices for ASTM Centrifuged Concentrated natural latex, in tank-car quantities, f.o.b. rail tank cars, ranged during the period from 42 to 47¢ per pound solids. Prices of synthetic latices remained steady at about 26 to 32¢ for SBR; 37-47¢ for neoprene; and 46-54¢ a pound for N--types.

Final October and preliminary November domestic statistics for all latices were reported by the United States Department of Commerce as follows:

(All Figures in Long Tons, Dry Weight)

Type of Latex	Production	Imports	Consumption	Month-End Stocks
Natural				
Oct.	0	5,738	7,825	12,322
Nov.	0	....	6,391	11,043
SBR				
Oct.	6,122	0	6,175	5,703
Nov.	6,022	....	5,592	6,403
Neoprene				
Oct.	908	0	795	1,263
Nov.	886	0	711	1,165
Nitrile				
Oct.	1,183	0	681	1,680
Nov.	1,175	0	555	1,487

Reclaimed Rubber

Reclaimed rubber business continued very slow during the December 16-January 15 period, according to industry sources. Disappointing automotive production was cited as the main reason for this lethargy. The final two weeks in January, however, were expected to show an improvement.

Dollar value of imports and exports of reclaimed rubber during September was not available at this writing.

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Constance Bannister

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Prices of reclaimed rubber during the December 16-January 15 period were unchanged.

RECLAIMED RUBBER PRICES

	Lb.
Whole tire: first line	$0.105
Fourth line	.0925
Inner tube: black	.15
Red	.21
Butyl	.14
Pure gum, light colored	.23
Mechanical, light colored	.135

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

Scrap Rubber

Trading in the scrap rubber market during the December 16-January 15 period was called dull by industry observers. Some improvement was noted in demand for black passenger tubes, with the price of these grades becoming firmer in the East, but remaining the same at Akron. Moving of scrap rubber to Naugatuck and other points was hampered by snowfalls and cold weather.

Dollar value of imports and exports of scrap rubber during September was not available at this writing.

Period-end prices of scrap rubber grades were:

	Eastern Points	Akron, O.
	(Per Net Ton)	
Mixed auto tires	$10.00/13.50	$13.50/14.00
S.A.G. auto tires	Nom.	Nom.
Truck tires	Nom.	Nom.
Peelings, No. 1	40.00	40.00
2	Nom.	Nom.
3	16.00	17.00
Tire buffing	Nom.	Nom.
	(¢ per Lb.)	
Auto tubes, mixed	2.75	2.75
Black	6.25	5.75
Butyl	3.75	3.75
Red	6.75	6.75

Rayon

During the first 11 months of 1956, producers shipped a total of 1,031,900,000 pounds of rayon and acetate to the domestic and export markets, a figure 11% below the 1,158,500,000 pounds delivered during the comparable 1955 period, according to a year-end review of the industry by *Textile Organon*, synthetic fiber trade publication. Producers' shipments for the year are put at approximately 1,130,000,000 pounds, a fall of 10½% from the 1,261,900,000 pounds shipped during 1955. Consumption of rayon and acetate in 1956 is estimated at about 1,200,000,000 pounds, a 15½% decline from the record 1955 total of 1,419,100,000 pounds, but slightly higher than the 1,154,700,000 pounds consumed in 1954.

Production of rayon tire cord and fabric also fell off in 1956. In the first three quarters of the year production totaled 258,000,000 pounds, a 15% drop from the 304,000,000 pounds produced during the first three quarters of 1955.

December and year-end statistics of the rayon and acetate industry will be published in these columns next month.

Current prices of tire yarns and fabrics are as follows:

RAYON PRICES

Tire Yarns	
High-Tenacity	
1100/ 480	$0.59/$0.64
1100/ 490	.59/ .64
1150/ 490	.64
1165/ 480	.65
1230/ 490	.64
1650/ 720	.55/ .61
1650/ 980	.55/ .61
1875/ 980	.61
2200/ 960	.55/ .60
2200/ 980	.55/ .60
2200/1466	.64
4400/2934	.60
Super-High-Tenacity	
1650/ 720	.58
1900/ 720	.58
Tire Fabrics	
1100/490/2	.77
1650/980/2	.725
2200/980/2	.715

Cotton Fabrics

An easy tone continued to prevail in wide industrial fabrics during the December 16-January 15 period. There was a general lack of inquiries and buying. A revival in forward buying of wide industrial fabrics had been expected by trade observers due to heavier automotive production. This step-up, however, has not been sufficient enough to spur any general buying. Stocks were thought to be adequate enough to take care of immediate needs.

Prices of chafer fabrics dropped about 3¢ a yard during the period. Drills and sateens generally fell about 1¢ a yard. Period-end prices were:

INDUSTRIAL FABRICS

Drills		
59-inch 1.85 yd.	*yd.*	$0.365
2.25-yd.		.315
Ducks		
38-inch 1.78-yd. S.F.	*yd.*	nom.
2.00-yd. D.F.		.3175
51.5-inch, 1.35-yd. S.F.		nom.
Hose and belting		.69
Osnaburgs		
40-inch 2.11-yd.	*yd.*	.25
3.65-yd.		.16
Raincoat Fabrics		
Printcloth, 38½-in., 64x60, 5.35-yd.	*yd.*	.14
6.25 yd.		.12
Sheeting, 48-inch, 4.17-yd.		.20
52-inch, 3.85-yd.		.23
Chafer Fabrics		
14.40-oz./sq. yd. Pl.	*yd.*	nom.
11.65-oz./sq. yd. S.		.61
10.80-oz/sq. yd. S.		.6575
8.9-oz/sq. yd. S.		.67
Other Fabrics		
Headlining, 59-in., 1.65-yd., 2-ply	*yd.*	.41
64-inch, 1.25-yd., 2-ply		.59
Sateens, 53-inch, 1.32-yd.		.575
58-inch, 1.21-yd.		.615

NEWS FROM ABROAD

(Continued from page 760)

Great Britain

An International Synthetic Rubber Symposium, organized by the *Rubber and Plastics Age*, of London, has been scheduled for Church House, Westminster, London, March 26-28. The papers, by American, British, and German experts, will include:

"Ameripol SN Rubber," R. P. Kenny, B. F. Goodrich Chemical Co.; "Auxiliary Materials for Synthetic Rubber," W. McG. Morgan, Monsanto Chemicals, Ltd.; "British Developments in Synthetic Rubber," E. A. Murphy, Dunlop Research Center; "Butadiene-Vinyl Pyridene Copolymers," W. Gumlich, Chemische Werke Nuls, A.G.; "Butyl—Part I—General," W. C. Smith, W. L. Dunkle, R. L. Zapp, Enjay Laboratories; "Part II—Butyl Rubber Tires," D. J. Buckley, Esso Research & Engineering Co.; "Effect of *Cis-Trans* Ratio on the Physical Properties of 1, 4-Polybutadienes," J. N. Short, V. Thornton, G. Kraus, Phillips Petroleum Co.; "German Synthetic Rubber Developments," P. Baumann, Chemische Werke Nuls; "Neoprene Latices," E. P. Hartsfield, E. I. du Pont de Nemours & Co., Inc.; "Nitrile and Acrylic Rubbers," S. Mottram and P. H. Starner, British Geon, Ltd.; "Organic Fluorine Rubbers," J. C. Tatlow, University of Birmingham; "Self-Reinforcing Elastomers," Polymer Corp., Ltd.; "Silicone Rubber—Its Growth and Recent Developments," P. C. Servais, Dow Corning Corp., and I. H. Riley, Midland Silicones, Ltd.

France

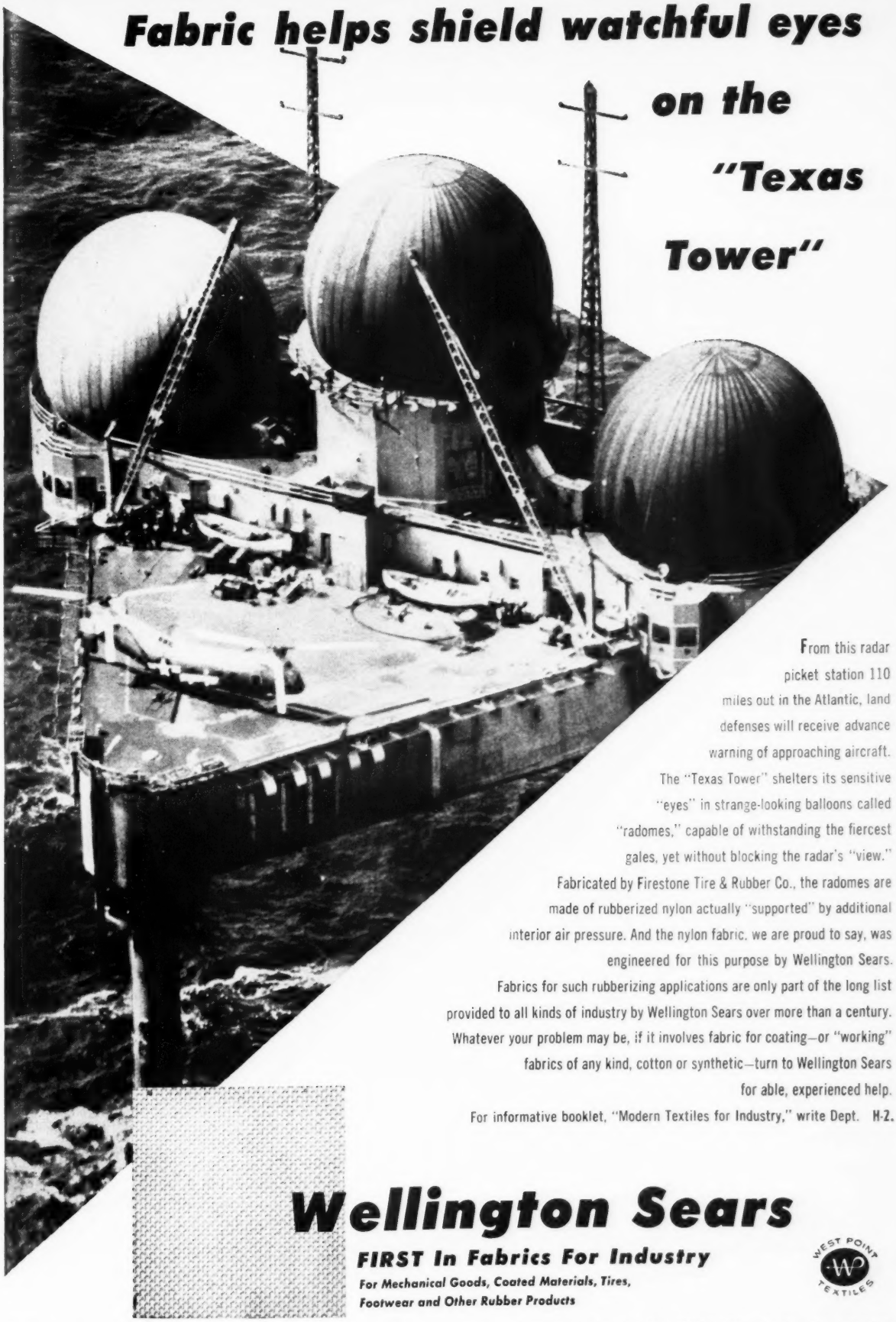
Improvements in pneumatic tires recently patented by Michelin (French patent No. 1,120,113) consist in the total or partial elimination of the carcass in pneumatic tires, only retaining, where they are needed, the bead wires and the breaker strips.

The inventors have found that the customary reinforcement of sidewalls by fabric plies is not indispensable and can be eliminated completely or in part, even with advantage in some cases. Variations of the new construction are described; if required, the parts of the tire made without carcass can be reinforced by increasing their thickness and using rubber with a higher modulus of elasticity, or a synthetic plastic, in their manufacture.

Attention is called[1] to similar views expressed by R. Hublin, head of the research department of the Institut Français du Caoutchouc, in a paper read at the International Tire Symposium, held in Delft, Holland, in May, 1955. Hublin then envisaged a tire made entirely of an elastomer having a very high modulus of elasticity, which would offer great advantages especially because the simplicity of tire construction would make far-reaching automation of tire manufacturing methods possible.

[1] *Rev. gén. caoutchouc*, Nov., 1956, p. 996.

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STATISTICS of the RUBBER INDUSTRY

U.S.A. Imports and Production of Natural (Including Latex and Guayule) and Synthetic Rubber (in Long Tons)

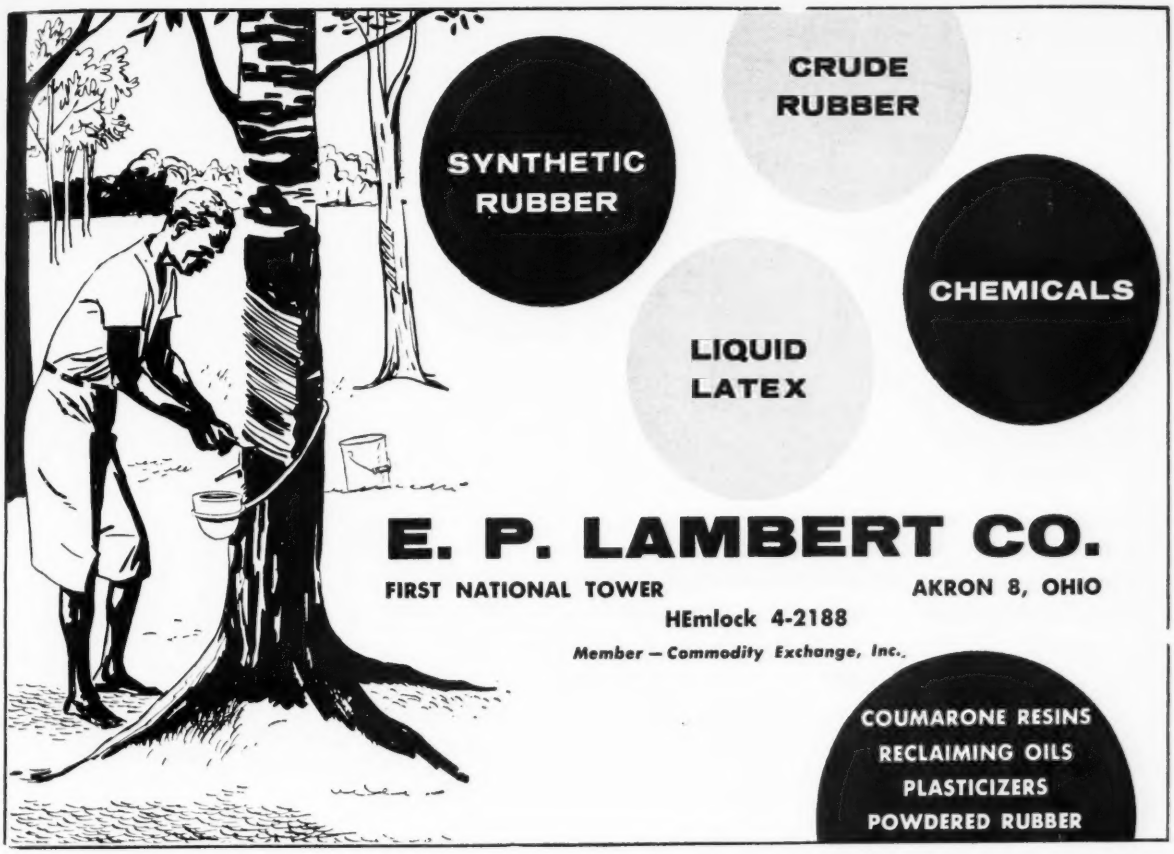
Year	Natural	GR-S	SBR-Types	Butyl	Neoprene	N-Type	Total Natural and Synthetic
1951	**733,048**	**694,583**	**9,946**	**76,475**	**58,907**	**15,333**	**1,588,292**
1952	**805,997**	**636,969**	**17,885**	**81,630**	**65,745**	**16,228**	**1,624,454**
1953	**647,615**	**668,386**	**12,342**	**79,801**	**80,495**	**20,198**	**1,508,837**
1954	**596,848**	**472,698**	**17,707**	**58,802**	**69,150**	**21,396**	**1,236,601**
1955							
Jan.	**49,941**	**57,607**	**1,436**	3,220	6,983	2,215	121,402
Feb.	**50,880**	**55,293**	**1,149**	3,727	6,910	1,659	119,618
Mar.	**61,250**	**63,940**	**1,229**	5,256	7,132	2,409	141,216
Apr.	**61,113**	**50,745**	**10,081**	5,148	8,359	2,433	137,879
May	61,042	3,592	63,220	5,115	7,852	2,720	143,541
June	52,762	3,739	61,717	3,872	5,919	3,422	131,431
July	43,626	1,640	64,910	5,395	6,904	3,195	125,670
Aug.	59,840	....	68,898	4,203	8,511	2,792	144,244
Sept.	50,459	....	68,228	5,097	7,677	2,821	134,282
Oct.	45,720	....	73,103	5,501	8,118	2,958	135,400
Nov.	50,509	....	75,745	4,935	8,537	2,931	142,657
Dec.	48,032	....	74,813	4,710	8,455	3,068	139,078
Total	635,174	236,556	564,589	56,179	91,357	32,623	1,616,478
1956							
Jan.	58,803	....	76,028	6,896	8,207	3,125	153,059
Feb.	56,497	....	73,457	6,229	8,560	2,989	147,732
Mar.	52,749	....	77,812	5,686	7,822	3,663	147,732
Apr.	51,394	....	74,502	5,685	8,481	3,648	143,710
May	39,789	....	78,309	5,647	7,795	2,903	134,443
June	36,694	....	69,820	4,638	8,929	2,350	122,431
July	41,195	....	70,831	7,192	7,935	2,460	129,613
Aug.	40,367	....	70,122	7,118	7,769	2,141	127,517
Sept.	42,974	....	73,321	7,252	8,328	2,322	134,197
Oct.	52,638	....	70,690	7,018	8,144	2,973	141,463
Nov.*	....	....	65,845	6,011	8,614	....	.....

* Preliminary.
Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.

U.S.A. Consumption of Natural (Including Latex) and Synthetic Rubber (Long Tons)

Year	Natural	GR-S	SBR-Types	Butyl	Neoprene	N-Type	Total Natural and Synthetic
1951	**454,015**	**617,200**	**9,244**	**70,500**	**48,887**	**13,066**	**1,212,912**
1952	**453,846**	**648,816**	**17,604**	**71,229**	**55,522**	**13,866**	**1,260,883**
1953	**553,473**	**611,748**	**12,433**	**77,826**	**65,900**	**16,929**	**1,338,309**
1954	**596,285**	**483,001**	**17,344**	**61,464**	**57,203**	**17,715**	**1,233,412**
1955							
Jan.	**56,911**	**54,728**	**1,643**	4,478	5,676	1,931	125,367
Feb.	**50,997**	**54,707**	**1,293**	4,312	5,476	1,921	118,706
Mar.	**58,472**	**62,548**	**1,189**	4,839	6,423	2,174	135,645
Apr.	**52,963**	**54,091**	**5,655**	4,321	5,884	2,172	125,086
May	54,746	2,533	60,325	4,455	6,143	1,965	130,167
June	56,282	3,666	62,226	4,704	6,320	2,581	135,779
July	46,166	2,690	50,398	3,894	4,294	1,621	109,063
Aug.	48,359	....	59,746	4,307	6,450	2,219	121,268
Sept.	50,963	....	63,330	4,578	6,197	2,270	127,338
Oct.	54,995	....	66,744	4,739	6,626	2,280	135,374
Nov.	52,769	....	68,111	4,420	6,896	2,234	134,430
Dec.	48,377	....	63,149	4,219	6,491	2,167	124,403
Yr.-end adj.	+2,800	....	+3,225	+725	....	+500	+7,250
Total	634,800	234,963	507,034	53,991	72,876	26,035	1,529,699
1956							
Jan.	53,751	....	65,375	4,223	6,684	2,198	132,231
Feb.	50,285	....	62,366	4,155	6,430	2,289	125,525
Mar.	50,040	....	64,458	4,515	6,542	2,373	127,928
Apr.	47,446	....	62,179	4,228	6,125	2,150	122,128
May	48,342	....	63,629	4,285	6,379	2,103	124,738
June	43,638	....	56,390	4,026	5,536	1,864	111,454
July	38,353	....	48,907	3,316	4,435	1,538	96,549
Aug.	46,700	....	59,756	4,102	6,554	2,125	119,237
Sept.	44,179	....	57,135	4,044	6,057	1,969	113,384
Oct.	52,188	....	67,399	4,780	7,478	2,366	134,211
Nov.*	42,777	....	58,985	4,128	6,756	2,089	114,735

* Preliminary.
Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.



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U.S.A. Stocks of Synthetic Rubber

(Long Tons)

Year	SBR-Types	Butyl	Neoprene	N-Type	Total
1948	96,304	10,995	5,072	2,762	115,133
1949	77,743	12,224	4,654	3,433	98,054
1950	36,942	7,243	5,733	2,840	52,758
1951	105,271	12,481	8,379	3,821	129,952
1952	83,861	22,716	8,535	3,875	118,987
1953	135,153	24,866	11,480	4,346	175,845
1954	115,499	19,267	11,349	4,280	150,395
1955					
Jan.	114,976	17,079	11,598	4,121	147,774
Feb.	111,796	15,424	10,555	3,888	141,663
Mar.	113,594	15,096	11,037	3,860	143,587
Apr.	112,156	14,813	10,863	3,612	141,444
May	109,381	14,449	10,283	3,995	138,108
June	103,844	13,053	9,755	4,042	130,694
July	110,281	13,288	11,213	5,120	139,902
Aug.	108,211	12,395	11,326	5,118	137,050
Sept.	107,641	12,190	11,209	4,995	136,035
Oct.	105,746	12,146	11,820	5,041	134,753
Nov.	105,287	11,646	11,530	5,201	133,664
Dec.	108,339	10,180	12,220	5,580	136,319
Yr.-end adj.	+650	+320	.....	+450	+1,420
	108,989	10,500	12,220	6,030	137,739
1956					
Jan.	111,263	12,303	11,850	6,316	141,732
Feb.	114,389	13,027	11,888	6,602	145,906
Mar.	118,063	13,458	12,037	7,437	150,995
Apr.	121,054	14,071	12,042	8,243	155,370
May	127,163	15,253	11,478	8,788	162,682
June	133,570	15,744	12,927	8,955	171,196
July	145,601	18,899	15,084	9,229	188,813
Aug.	148,176	21,267	14,540	8,503	192,486
Sept.	154,841	23,862	14,055	8,035	200,793
Oct.	151,646	25,734	12,841	7,567	197,788
Nov.*	151,354	26,971	13,472	7,667	199,464

Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.
* Preliminary.

U.S.A. Stocks of Latex

(Long Tons, Dry Weight)

Year	Natural	GR-S*	Neoprene	N-Type	Total Synthetic	Total Natural & Synthetic
1948	11,235	....	....	....	....	11,235
1949	5,063	....	....	....	....	5,063
1950	4,927	....	....	....	....	4,927
1951	4,752	3,727	1,245	532	5,504	10,256
1952	6,201	5,040	1,019	902	6,961	13,162
1953	13,532	4,794	1,117	721	6,632	20,164
1954	11,133	5,134	1,087	811	7,032	18,165
1955						
Jan.	9,684	5,861	1,067	812	7,740	17,424
Feb.	8,619	5,753	879	692	7,324	15,943
Mar.	7,820	6,940	909	658	8,507	16,327
Apr.	6,790	7,098	786	725	8,609	15,399
May	8,854	7,021	767	842	8,630	17,484
June	9,788	6,645	817	958	8,420	18,208
July	11,934	6,950	850	1,155	8,955	20,889
Aug.	11,962	6,201	885	1,076	8,162	20,124
Sept.	12,595	6,448	975	1,296	8,719	21,314
Oct.	12,156	5,798	1,075	1,196	8,069	20,225
Nov.	12,616	6,307	1,089	1,174	8,570	21,186
Dec.	12,628	6,480	1,236	1,282	8,998	21,626
Yr.-end adj.	+575	+500	....	+525	+1,025	+1,600
	13,203	6,980	1,236	1,807	10,023	23,226
1956						
Jan.	16,059	6,522	1,093	1,906	9,521	25,580
Feb.	16,735	7,011	1,162	1,943	10,116	26,851
Mar.	18,309	6,867	1,097	2,340	10,304	28,613
Apr.	21,384	7,415	1,163	2,272	10,850	32,234
May	21,234	7,516	1,218	2,194	10,928	32,162
June	21,033	7,447	1,328	2,086	10,861	31,894
July	19,952	7,288	1,109	2,009	10,406	30,358
Aug.	18,099	6,402	1,076	1,703	9,181	27,280
Sept.	15,403	6,625	1,328	1,523	9,476	24,879
Oct.	12,322	5,703	1,263	1,680	8,646	20,968
Nov.†	11,043	6,403	1,165	1,487	9,055	20,098

Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce
* Includes SBR-Types.
† Preliminary.

U.S.A. Imports and Production of Natural and Synthetic Latices

(Long Tons, Dry Weight)

Year	Natural	GR-S*	Neoprene	N-Type	Total Synthetic	Total Natural & Synthetic
1948	32,630	21,494	5,022	....	26,516	59,146
1949	29,974	21,357	3,651	....	25,008	54,982
1950	54,401	31,339	5,725	....	37,064	91,465
1951	54,963	32,972	6,866	2,948	42,786	97,749
1952	48,228	42,273	7,598	4,164	54,035	102,263
1953	75,511	48,112	9,026	5,844	62,982	138,493
1954	74,483	48,379	8,214	6,866	63,459	137,942
1955						
Jan.	7,853	6,199	617	708	7,524	15,377
Feb.	6,110	5,634	797	525	6,956	13,066
Mar.	7,611	7,078	854	738	8,670	16,281
Apr.	8,550	5,680	975	972	7,627	16,177
May	8,849	5,337	880	815	7,032	15,881
June	7,736	4,777	905	1,450	7,132	14,868
July	8,702	4,800	641	951	6,392	15,094
Aug.	8,885	4,519	881	1,010	6,410	15,295
Sept.	8,109	5,769	994	1,091	7,854	15,963
Oct.	6,900	6,231	922	883	8,036	14,936
Nov.	7,085	6,933	1,004	781	8,718	15,803
Dec.	6,364	6,407	962	874	8,243	14,607
Total	92,754	69,364	10,432	10,798	90,594	183,348
1956						
Jan.	10,328	6,885	848	919	8,652	18,980
Feb.	7,965	6,943	930	827	8,700	16,665
Mar.	7,800	5,911	782	1,158	7,851	15,651
Apr.	6,995	6,097	969	866	7,922	14,917
May	5,731	4,966	939	614	6,519	12,250
June	5,006	4,776	907	543	6,226	11,232
July	3,522	4,241	444	731	5,416	8,938
Aug.	4,715	4,902	882	684	6,468	11,183
Sept.	2,790	5,723	1,180	938	7,841	10,631
Oct.	5,738	6,122	908	1,183	8,213	13,951
Nov.†	....	....	886	1,175	....	....

Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.
* Includes SBR-Types.
† Preliminary.

U.S.A. New Supply, Consumption, Exports, and Stock of Reclaimed Rubber

(Long Tons)

Year	New Supply	Consumption	Exports	Stocks
1948	266,861	261,113	11,428	32,630
1949	224,029	222,679	10,367	28,263
1950	314,008	303,733	11,740	35,708
1951	366,700	346,121	14,722	45,082
1952	274,981	280,002	11,180	30,664
1953	298,336	285,050	11,397	32,319
1954	258,101	249,049	10,232	30,746
1955				
Jan.	25,336	25,322	1,041	29,656
Feb.	25,444	24,333	1,085	30,125
Mar.	29,574	28,674	1,088	30,311
Apr.	26,817	26,609	1,088	30,068
May	27,911	27,652	1,056	29,528
June	30,451	29,157	1,128	29,725
July	24,114	22,563	1,176	29,939
Aug.	25,223	25,790	1,144	27,956
Sept.	26,512	26,340	1,018	27,110
Oct.	28,038	26,597	1,381	27,565
Nov.	29,124	27,229	1,313	28,473
Dec.	28,105	24,515	1,470	31,058
Year.-end adj.	.....	—2,000	.....	+440
Total	326,649	312,781	13,988	31,498
1956				
Jan.	26,205	25,827	1,382	31,646
Feb.	27,108	25,571	1,115	31,875
Mar.	28,468	26,176	1,163	33,326
Apr.	26,933	23,999	1,179	34,360
May	25,485	23,560	1,297	34,863
June	22,153	20,560	1,264	35,647
July	19,776	18,099	952	35,703
Aug.	21,724	21,498	1,076	35,512
Sept.	22,368	20,242	1,015	36,527
Oct.	26,318	23,946	1,298	37,904
Nov.*	19,958	20,699	....	35,930

Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.
* Preliminary.



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U.S.A. Exports of Synthetic Rubber

(Long Tons)

Year	SBR-Types	Butyl	Neoprene	N-Type	Total
1954	11,069	2,831	12,062	4,155	30,117
1955					
Jan.	1,381	716	1,046	194	3,337
Feb.	1,331	370	1,049	259	3,009
Mar.	2,162	672	1,287	236	4,357
Apr.	1,807	1,562	1,636	506	5,511
May	3,500	376	1,430	357	5,663
June	6,030	726	1,541	389	8,686
July	5,212	870	1,275	472	7,829
Aug.	7,727	837	1,454	386	9,567
Sept.	8,598	526	1,946	602	11,672
Oct.	7,888	1,041	1,748	444	11,121
Nov.	7,786	894	1,824	306	10,810
Dec.	7,282	1,305	1,862	442	10,891
Total	60,704	9,895	18,098	4,593	93,290
1956					
Jan.	7,550	815	1,757	506	10,628
Feb.	9,018	1,624	1,521	449	12,612
Mar.	10,804	764	1,500	522	13,590
Apr.	10,271	374	1,917	587	13,149
May	10,864	743	2,142	443	14,192
June	9,310	746	2,088	548	12,692
July	9,038	523	1,994	433	11,988
Aug.	9,607	654	2,268	274	12,803
Sept.	8,804	439	2,824	403	12,470
Oct.	6,795	454	1,013	618	8,880

Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.

U.S.A. Automotive Inner Tubes

(Thousands of Units)

	Shipments					
Year	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1954	25,090	35,442	948	61,480	58,397	9,299
1955						
Jan.	413	3,629	74	4,116	3,089	8,252
Feb.	352	2,430	80	2,862	2,850	8,243
Mar.	491	2,732	105	3,328	3,234	8,217
Apr.	530	2,635	85	3,250	2,836	7,963
May	531	2,617	85	3,233	3,005	7,735
June	477	3,003	85	3,565	3,136	7,326
July	475	2,915	60	3,450	2,768	6,664
Aug.	394	3,274	65	3,733	2,923	5,917
Sept.	360	2,814	86	3,261	3,169	5,966
Oct.	319	2,595	89	3,004	3,119	6,286
Nov.	355	2,427	93	2,875	3,052	6,734
Dec.	305	2,289	92	2,686	2,719	6,833
Total	5,002	33,360	999	39,363	35,900	
1956						
Jan.	274	3,263	72	3,608	2,918	6,294
Feb.	273	2,548	100	2,921	2,969	6,547
Mar.	282	2,587	93	2,962	3,347	6,848
Apr.	265	2,444	88	2,797	3,094	7,312
May	280	2,515	83	2,878	3,093	7,657
June	269	3,023	79	3,370	2,837	7,349
July	248	3,055	82	3,384	2,300	6,418
Aug.	242	2,954	99	3,295	2,795	5,962
Sept.	213	2,472	91	2,777	2,774	6,056
Oct.	261	2,514	102	2,877	3,025	6,469
Nov.	259	2,468	65	2,792	2,585	6,250

Source: The Rubber Manufacturers Association, Inc.

Canadian Rubber Consumption By Main Products

(Long Tons)

	1955	First Quarter 1956	Second Quarter 1956	Third Quarter 1956
Tires and tubes	55,824	14,820	15,986	14,260
Wire and cable	2,460	834	970	844
Footwear	8,148	2,017	2,053	1,806
Miscellaneous	18,096	4,506	4,769	3,940
Total	84,528	22,177	23,778	20,850

Source: Secretariat of the International Rubber Study Group.

U.S.A. Consumption of Natural and Synthetic Latices

(Long Tons, Dry Weight)

Year	Natural	GR-S*	Neoprene	N-Type	Total Synthetic	Total Natural & Synthetic
1954	75,931	44,173	7,251	4,507	55,931	131,862
1955						
Jan.	7,355	4,537	661	509	5,707	13,062
Feb.	7,066	4,881	689	505	6,075	13,141
Mar.	8,415	5,861	828	512	7,201	15,616
Apr.	7,732	5,209	748	606	6,563	14,295
May	6,643	4,278	768	496	5,542	12,185
June	6,589	4,885	722	591	6,198	12,787
July	5,469	3,830	535	430	4,795	10,264
Aug.	6,784	4,514	770	547	5,831	12,615
Sept.	7,452	5,505	730	595	6,830	14,282
Oct.	7,209	5,704	739	614	7,057	14,266
Nov.	6,620	5,954	829	603	7,386	14,006
Dec.	6,344	5,599	717	587	6,903	13,247
Yr.-end adj.	+2,800	+2,775	...	+1,900	+4,675	+7,475
Total	86,478	63,982	8,736	8,495	81,213	167,691
1956						
Jan.	6,776	5,858	772	670	7,300	14,076
Feb.	6,399	5,913	787	730	7,430	13,829
Mar.	6,438	5,888	729	781	7,398	13,836
Apr.	5,693	4,923	741	692	6,356	12,049
May	5,239	4,745	778	691	6,214	11,453
June	5,171	4,350	637	657	5,644	10,815
July	4,855	3,731	562	466	4,759	9,614
Aug.	6,374	5,055	816	698	6,569	12,943
Sept.	6,233	4,937	692	699	6,328	12,561
Oct.	7,825	6,175	795	681	7,651	15,476
Nov.†	6,391	5,592	711	555	6,858	13,249

Source: Chemical & Rubber Division, Business & Defense Services Administration, United States Department of Commerce.
† Preliminary. * Includes SBR-Types.

U.S.A. Rubber Industry Sales and Inventories

(Million of Dollars)

	Value of Sales*				Manufacturers' Inventories*			
	1953	1954	1955	1956	1953	1954	1955	1956
Jan.	424	348	424	415	866	844	790	935
Feb.	435	351	440	445	868	857	782	970
Mar.	473	388	466	451	880	849	805	979
Apr.	444	375	445	445	874	812	784	970
May	422	357	465	464	888	810	810	985
June	436	377	465	450	914	829	850	975
July	448	374	471	459	925	784	853	987
Aug.	409	337	456	436	897	761	863	1,007
Sept.	416	334	456	429	908	804	874	1,007
Oct.	395	332	447	...	881	838	902	...
Nov.	346	388	482	...	867	819	935	...
Dec.	369	407	465	...	868	929	934	...
Total	5,017	4,368	5,493	....	Av. 853	831	845	....

Source: Office of Business Economics, U. S. Department of Commerce.
* Adjusted for seasonal variation.

U.S.A. Rubber Consumption By Main Products

(1,000 Long Tons)

	Transportation			Non-Transportation			
Year	Natural	Synthetic	Total	Natural	Synthetic	Total	Grand Total
1953	358.2	500.3	858.5	195.2	284.6	479.8	1,338.3
1954	386.3	391.0	777.3	210.0	245.7	455.7	1,233.0
1955	409.6	550.3	959.9	225.2	344.6	569.8	1,529.7
1956							
1st quart.	100.8	138.2	239.0	53.3	93.4	146.7	385.7
2nd quart.	91.9	134.3	226.2	47.5	84.6	132.1	358.3
3rd quart.	83.7	123.9	207.6	45.5	76.0	121.5	329.1

Source: Secretariat of the International Rubber Study Group.

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World Production of Natural Rubber

(1,000 Long Tons)

Year	Malaya Estate	Malaya Native	Indonesia Estate	Indonesia Native	All Other	Total
1955						
Jan.	29.3	27.9	23.6	17.1	42.1	140.0
Feb.	28.5	20.4	22.3	48.1	38.2	157.5
Mar	27.5	26.7	23.0	23.8	39.0	140.0
Apr.	24.2	20.5	20.7	27.4	42.2	135.0
May	27.4	22.4	18.0	30.1	37.1	135.0
June	27.6	22.9	21.3	52.7	40.5	165.0
July	30.3	25.7	21.2	32.5	55.3	165.0
Aug.	30.7	23.6	20.0	43.2	37.5	155.0
Sept.	31.3	24.9	20.3	45.2	45.8	167.5
Oct.	30.8	24.0	22.0	44.8	48.4	170.0
Nov.	30.3	21.9	23.4	37.3	44.6	157.5
Dec.	35.0	27.3	24.5	70.2	50.5	207.5
Total	352.9	286.2	261.3	472.4	521.2	1,895.0
1956						
Jan.	32.6	26.5	23.5	17.4	42.5	142.5
Feb.	27.6	24.3	23.0	20.9	36.7	132.5
Mar.	28.5	22.5	21.5	16.4	41.1	130.0
Apr.	26.7	21.7	20.0	46.1	40.4	155.0
May	23.5	19.8	18.0	38.4	37.8	137.5
June	29.5	23.2	21.9	25.9	44.5	145.0
July	30.8	23.9	21.3	41.5	45.0	162.5
Aug.	30.3	23.0	20.3	64.0	44.9	182.5
Sept.	30.2	21.9	21.3	29.0	42.6	145.0
Oct.	30.5	22.5	22.0	34.0	53.5	162.5

Source: BDSA, United States Department of Commerce; Secretariat of the International Rubber Study Group; and United Baltic Corp., Ltd.

World Production of Synthetic Rubber

(1,000 Long Tons)

Year	U.S.A.	Canada	Germany	Total
1955				
Jan.	69.9	8.1	0.9	78.9
Feb.	67.7	7.6	0.9	76.2
Mar.	78.5	8.7	0.8	88.0
Apr.	75.7	7.6	0.8	84.1
May	82.0	8.9	0.9	91.7
June	78.2	8.6	0.9	87.7
July	81.9	8.2	0.9	91.0
Aug.	84.0	8.1	1.0	93.1
Sept.	83.5	9.3	0.9	93.7
Oct.	89.1	9.9	1.0	100.0
Nov.	91.3	9.2	1.0	101.5
Dec.	90.3	9.7	1.0	101.0
Total	970.5	103.9	10.9	1,085.3
1956				
Jan.	93.5	9.7	1.0	104.3
Feb.	90.5	8.2	1.0	99.7
Mar.	94.4	10.3	1.1	105.8
Apr.	91.6	10.3	1.0	102.8
May	93.7	10.6	1.0	105.3
June	85.3	10.4	0.6	96.3
July	88.0	8.7	1.0	97.7
Aug.	86.5	10.2	0.9	97.6
Sept.	90.6	10.7	0.8	102.1
Oct.	88.2	10.7	0.8	99.7

Source: Secretariat of the International Rubber Study Group; and BDSA United States Department of Commerce.

U.S.A. Synthetic Rubber Exports, by Country (Including Latices)

January-September, 1956 (Long Tons)

Country	SBR-Types	Butyl	Neoprene	N-Type	Total
U.K.	14,104	259	3,419	503	18,285
Belgium	2,779	378	4,217	128	7,502
France	10,082	1,736	873	463	13,154
Germany	8,657	1,794	1,920	454	12,807
Italy	4,679	242	1,210	469	6,600
Sweden	2,097	56	116	268	2,537
Argentina	2,261	221	234	34	2,750
Australia	7,556	174	318	81	8,129
Canada	5,205	8	2,351	211	7,775
Japan	2,443	375	1,580	819	5,217
Mexico	6,050	551	142	69	6,812
South Africa	6,277	390	382	30	7,079
Venezuela	2,169	79	35	0	2,283
All others	10,905	418	1,215	637	13,175
Total	85,264	6,681	18,012	4,166	114,123

Source: Secretariat of the International Rubber Study Group.

World Consumption of Natural Rubber

(1,000 Long Tons)

Year	United States	U.S.S.R.* and China	United Kingdom	Other Foreign	Total Foreign	Grand* Total
1955						
Jan.	56.9	7.8	23.5	71.8	103.1	160.0
Feb.	51.0	....	20.1	....	89.0	140.0
Mar.	58.5	7.3	21.4	72.8	101.5	160.0
Apr.	53.0	....	23.3	....	104.5	157.5
May	54.7	....	20.5	....	97.8	152.5
June	56.3	2.8	18.3	80.1	101.2	157.5
July	46.2	1.8	18.3	73.7	93.8	140.0
Aug.	48.4	0.1	16.0	65.5	81.6	130.0
Sept.	51.0	2.1	19.8	72.1	94.0	145.0
Oct.	55.0	10.4	22.9	76.7	110.0	165.0
Nov.	52.8	17.1	20.0	77.6	114.7	167.5
Dec.	51.2	5.2	22.2	83.9	111.3	162.5
Total	634.8	56.2	246.3	900.2	1,202.7	1,837.5
1956						
Jan.	53.4	14.4	21.7	73.0	109.1	162.5
Feb.	50.1	19.1	17.9	72.9	109.9	160.0
Mar.	49.6	11.7	16.0	73.7	100.4	150.0
Apr.	47.0	14.6	18.4	72.5	105.5	152.5
May	48.3	16.8	14.5	75.4	106.7	155.0
June	43.6	20.8	16.1	82.0	118.9	162.5
July	38.4	16.6	14.7	75.3	106.6	145.0
Aug.	46.7	7.1	10.3	73.4	90.8	137.5
Sept.	44.2	17.1	14.5	79.2	110.8	155.0
Oct.	51.3	15.5	18.8	74.4	108.7	160.0

Source: BDSA, United States Department of Commerce; Secretariat of the International Rubber Study Group; and United Baltic Corp., Ltd.
* Estimated.

World Consumption of Synthetic Rubber*

(1,000 Long Tons)

Year	U.S.A.	Canada	United Kingdom	Total† Continent of Europe	World‡ Grand Total
1955					
Jan.	68.4	2.6	1.2	5.8	80.0
Feb.	67.6	3.1	1.1	5.5	77.5
Mar.	77.1	3.4	1.2	6.0	90.0
Apr.	72.1	3.0	1.5	5.8	85.0
May	75.7	3.3	1.4	6.0	87.5
June	80.2	3.8	1.5	6.5	92.5
July	63.3	2.7	1.4	6.3	75.0
Aug.	73.3	2.7	1.5	6.3	87.5
Sept.	76.7	3.7	1.9	7.0	92.5
Oct.	80.4	3.6	2.6	7.5	97.5
Nov.	81.7	4.4	2.4	8.0	97.5
Dec.	80.5	4.0	2.7	7.8	95.0
Total	894.9	40.2	20.5	78.3	1,057.5
1956					
Jan.	78.5	4.0	3.1	9.0	100.0
Feb.	75.2	4.1	3.1	9.0	95.0
Mar.	78.3	4.1	3.1	9.0	97.5
Apr.	73.7	4.4	3.6	8.8	97.5
May	76.4	4.5	3.2	8.5	97.5
June	67.8	4.0	3.6	9.5	90.0
July	58.2	3.7	2.9	8.8	80.0
Aug.	72.5	3.3	2.3	7.5	90.0
Sept.	69.2	3.9	3.2	9.3	90.0
Oct.	80.5	4.2	4.1	..	102.5

Source: Secretariat of the International Rubber Study Group; BDSA, United States Department of Commerce.
* Includes latices. † Figures estimated or partly estimated.

Natural Rubber Bureau Rubber Estimates for 1957*

	Production (Tons) Natural	Synthetic	Total
U.S.A.	.....	1,120,000	1,120,000
Malaya	635,000	.....	635,000
Indonesia	720,000	.....	720,000
Rest of world	540,000	145,000	685,000
Total	1,895,000	1,265,000	3,160,000
	Consumption (Tons)		
U.S.A.	570,000	930,000	1,500,000
U.K.	175,000	45,000	220,000
Rest of world	1,130,000	250,000	1,380,000
Total	1,875,000	1,225,000	3,100,000

*"Natural Rubber News," Jan., 1957.

SITUATIONS WANTED (Continued)

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U.S.A. Automotive Pneumatic Casings

(Thousands of Units)

	Shipments					
	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
Passenger Car						
1954	29,746	47,043	928	77,717	76,806	12,228
1955						
Jan.	3,481	4,139	79	7,699	7,797	12,363
Feb.	3,540	3,551	83	7,174	7,549	12,643
Mar.	4,326	4,255	104	8,685	8,810	12,874
Apr.	3,967	4,677	88	8,733	8,000	12,197
May	3,871	4,705	87	8,663	8,742	12,235
June	3,482	5,399	97	8,979	9,383	12,698
July	3,461	4,802	76	8,339	7,893	12,199
Aug.	2,984	5,058	60	8,103	7,585	11,636
Sept.	2,749	4,366	74	7,189	7,882	12,407
Oct.	3,172	3,556	74	6,802	8,160	13,806
Nov.	3,900	2,902	63	6,865	8,198	15,142
Dec.	3,641	2,746	81	6,467	7,223	15,963
Total	42,574	50,156	966	93,698	97,232	
1956						
Jan.	2,958	4,040	66	7,064	7,661	16,546
Feb.	2,919	3,387	90	6,396	7,571	17,701
Mar.	3,027	4,372	65	7,464	7,812	18,096
Apr.	2,787	4,994	67	7,847	7,530	17,649
May	2,349	5,203	65	7,617	7,628	17,714
June	2,162	5,659	64	7,885	6,600	16,443
July	2,471	5,482	73	8,026	5,669	14,088
Aug.	1,953	5,359	77	7,389	6,897	13,578
Sept.	1,262	4,427	70	5,758	6,647	14,468
Oct.	2,530	3,854	87	6,471	7,526	15,607
Nov.	3,179	3,255	62	6,496	6,580	15,596
Truck and Bus						
1954	3,592	8,111	826	12,529	12,347	2,546
1955						
Jan.	303	827	81	1,211	1,243	2,586
Feb.	294	730	74	1,098	1,196	2,678
Mar.	454	672	96	1,222	1,273	2,734
Apr.	489	639	76	1,204	1,153	2,693
May	481	655	65	1,202	1,208	2,701
June	449	730	76	1,255	1,320	2,763
July	429	909	51	1,389	1,134	2,485
Aug.	378	922	59	1,359	1,132	2,272
Sept.	393	804	66	1,264	1,243	2,268
Oct.	324	904	88	1,315	1,395	2,357
Nov.	403	690	87	1,180	1,405	2,584
Dec.	404	552	91	1,047	1,255	2,815
Total	4,801	9,034	910	14,746	14,957	
1956						
Jan.	444	629	65	1,139	1,318	2,971
Feb.	424	565	88	1,077	1,326	3,232
Mar.	439	662	62	1,163	1,382	3,465
Apr.	430	767	74	1,271	1,303	3,483
May	421	777	65	1,264	1,358	3,582
June	372	968	65	1,404	1,329	3,504
July	362	837	73	1,272	1,073	3,306
Aug.	349	820	86	1,254	1,154	3,217
Sept.	291	811	92	1,194	1,153	3,180
Oct.	378	849	78	1,305	1,273	3,168
Nov.	337	626	59	1,022	1,060	3,207
Total Automotive						
1954	33,338	55,154	1,754	90,246	89,153	14,774
1955						
Jan.	3,785	4,967	159	8,911	9,040	14,949
Feb.	3,833	4,281	157	8,272	8,745	15,321
Mar.	4,780	4,926	201	9,907	10,083	15,609
Apr.	4,457	5,315	165	9,937	9,153	14,890
May	4,352	5,361	152	9,865	9,949	14,936
June	3,931	6,129	174	10,234	10,703	15,460
July	3,890	5,711	128	9,729	9,027	14,684
Aug.	3,362	5,980	119	9,462	8,717	13,908
Sept.	3,142	5,171	140	8,453	9,125	14,675
Oct.	3,495	4,460	161	8,117	9,555	16,163
Nov.	4,303	3,592	150	8,045	9,603	17,727
Dec.	4,045	3,298	172	7,515	8,478	
Total	47,375	59,191	1,878	108,447	112,178	
1956						
Jan.	3,402	4,669	131	8,203	8,979	19,517
Feb.	3,343	3,953	178	7,473	8,897	20,934
Mar.	3,466	5,034	127	8,627	9,193	21,562
Apr.	3,217	5,761	141	9,119	8,834	21,132
May	2,770	5,980	130	8,880	8,987	21,296
June	2,533	6,627	129	9,289	7,930	19,947
July	2,833	6,319	146	9,298	6,741	17,394
Aug.	2,303	6,179	163	8,644	8,050	16,795
Sept.	1,553	5,238	162	6,952	7,800	17,648
Oct.	2,908	4,703	165	7,776	8,799	18,775
Nov.	3,516	3,881	121	7,518	7,641	18,803

Source: The Rubber Manufacturers Association, Inc.

U.S.A. Rubber Industry Employment, Wages, Hours

Year	Production Workers (1000's)	Average Weekly Earnings	Average Weekly Hours	Average Hourly Earnings	Consumers Price Index
		All Rubber Products			
1939	121	$27.84	39.9	$0.75	....
1954	195	78.21	39.7	1.97	114.8
1955					
June	220.0	88.83	42.3	2.10	114.4
July	216.9	86.52	41.2	2.10	114.7
Aug.	219.0	86.32	41.3	2.09	114.5
Sept.	223.1	86.74	41.5	2.09	114.9
Oct.	226.4	89.04	42.0	2.12	114.9
Nov.	231.2	92.01	42.4	2.17	115.0
Dec.	233.9	89.21	41.3	2.16	114.7
1956					
Jan.	232.5	87.91	40.7	2.16	114.6
Feb.	227.6	85.81	40.1	2.14	114.6
Mar.	224.7	84.93	39.5	2.15	114.7
Apr.	224.6	85.79	39.9	2.15	114.9
May	215.9	86.18	39.9	2.16	115.4
June	211.3	84.93	39.5	2.15	116.2
July	207.3	86.15	39.7	2.17	117.0
Aug.	209.3	87.64	40.2	2.18	116.8
Sept.	216.6	89.95	40.7	2.21	117.1
Oct.	217.7	....	....	....	117.7
		Tires and Tubes			
1939	54.2	$33.36	35.0	$0.96	
1954	79.7	87.85	38.7	2.27	
1955					
June	91.0	105.60	43.1	2.45	
July	91.5	103.82	42.7	2.42	
Aug.	91.0	102.72	42.1	2.44	
Sept.	91.9	101.02	41.4	2.44	
Oct.	92.3	103.74	42.0	2.47	
Nov.	94.2	106.26	42.0	2.53	
Dec.	94.7	99.50	39.8	2.50	
1956					
Jan.	94.1	101.00	40.4	2.50	
Feb.	93.7	97.71	39.4	2.48	
Mar.	93.3	97.89	39.0	2.51	
Apr.	91.8	98.00	39.2	2.50	
May	91.6	99.00	39.8	2.51	
June	90.1	98.25	39.3	2.50	
July	90.8	98.14	39.1	2.51	
Aug.	89.8	101.20	40.0	2.53	
Sept.	92.2	103.02	40.4	2.55	
		Rubber Footwear			
1939	14.8	$22.80	37.5	$0.61	
1954	20.7	67.43	39.9	1.69	
1955					
June	21.6	71.34	41.0	1.74	
July	21.8	71.93	41.1	1.75	
Aug.	21.5	67.25	39.1	1.72	
Sept.	23.5	67.60	39.3	1.72	
Oct.	24.4	69.20	40.0	1.73	
Nov.	25.5	77.89	42.1	1.85	
Dec.	26.2	74.89	40.7	1.84	
1956					
Jan.	26.2	74.37	40.2	1.85	
Feb.	26.1	74.74	40.4	1.85	
Mar.	25.8	71.16	39.1	1.82	
Apr.	20.3	72.25	39.7	1.82	
May	20.0	72.25	39.7	1.82	
June	19.4	70.53	39.4	1.79	
July	18.9	71.28	39.6	1.80	
Aug.	19.2	70.35	39.3	1.79	
Sept.	19.3	71.71	39.4	1.82	
		Other Rubber Products			
1939	51.9	$23.34	38.9	$0.61	
1954	94.3	71.91	40.4	1.78	
1955					
June	106.4	77.93	41.9	1.86	
July	103.6	73.84	39.7	1.86	
Aug.	104.3	75.85	41.0	1.85	
Sept.	107.7	78.96	42.0	1.88	
Oct.	109.7	80.56	42.4	1.90	
Nov.	111.5	83.03	42.8	1.94	
Dec.	113.0	83.69	42.7	1.96	
1956					
Jan.	112.2	79.73	41.1	1.94	
Feb.	107.8	77.95	40.6	1.92	
Mar.	105.6	76.99	40.1	1.92	
Apr.	106.6	77.95	40.6	1.92	
May	104.7	76.40	40.0	1.91	
June	99.0	76.02	39.8	1.91	
July	99.1	77.78	40.3	1.93	
Aug.	101.8	78.76	40.6	1.94	
Sept.	105.2	81.38	41.1	1.98	

Source: BLS, United States Department of Labor.

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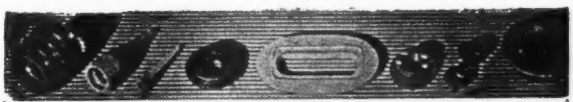
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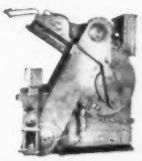
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Rubber Shipments Sent through the Suez Canal*

(1,000 Metric Tons)

Year	Quantity	Year	Quantity
1913	65	1934	873
1920	279	1935	657
1921	288	1936	294
1922	371	1937	541
1923	382	1938	505
1924	411	1939	352
1925	497	1946	732
1926	611	1947	1,007
1927	605	1948	1,179
1928	595	1949	1,167
1929	809	1950	1,356
1930	775	1951	1,369
1931	707	1952	1,384
1932	602	1953	1,246
1933	737	1954	1,217
		1955	1,349

*North-bound shipments as reported to the London Agency of Suez Canal Co. Countries of destination for 1955 shipments were indicated, in thousands of metric tons, as follows: U. K., 215; France, 67; Netherlands, 48; Italy, 26; Germany, 37; Belgium, 3; Poland 4; Other Europe, 5; and "Europe" not further specified, 413. Total Europe equalled 818. United States of America, 451; and Other Countries, 80; for a total of 1,349.
Source: Secretariat of the International Rubber Study Group.

U.S.A. Synthetic Rubber Industry, Wages, Hours

Year	Average Weekly Earnings	Average Weekly Hours	Average Hourly Earnings
1954	$90.76	40.7	$2.23
1955			
Jan.	93.02	40.8	2.28
Feb.	93.07	41.0	2.27
Mar.	94.12	41.1	2.29
Apr.	99.53	42.9	2.32
May	95.22	41.4	2.30
June	96.51	41.6	2.32
July	97.53	41.5	2.35
Aug.	99.96	42.0	2.38
Sept.	100.08	41.7	2.40
Oct.	98.83	41.7	2.37
Nov.	100.14	41.9	2.39
Dec.	100.98	41.9	2.41
1956			
Jan.	101.88	42.1	2.42
Feb.	101.57	41.8	2.43
Mar.	102.51	41.5	2.47
Apr.	102.75	41.6	2.47
May	103.00	41.2	2.50
June	103.41	41.2	2.51
July	103.41	41.5	2.50
Aug.	108.03	42.2	2.56
Sept.	104.65	41.2	2.54

Source: BLS, United States Department of Labor.

Carbon Black Statistics—First Eleven Months, 1956

Furnace blacks are classified as follows: SRF, Semi-reinforcing furnace black; HMF, high modulus furnace black; FEF, fast-extruding furnace black; HAF, high abrasion furnace black; SAF, semi-abrasion furnace black.

(Thousands of Pounds)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
Production											
Furnace types											
Thermal	11,874	11,478	12,127	10,665	11,712	11,483	11,577	12,413	11,927	13,534	12,994
SRF	34,047	30,367	31,692	28,711	31,622	29,081	30,860	29,504	29,107	30,005	27,072
HMF	10,401	8,681	7,984	8,764	8,972	8,066	7,479	8,437	8,394	8,628	10,611
FEF	20,776	19,518	21,359	19,948	18,339	20,118	17,890	15,270	14,995	16,321	15,883
HAF	36,802	36,807	38,058	33,832	38,830	37,542	38,334	35,679	31,211	40,764	39,571
SAF, ISAF	13,918	13,555	16,228	20,145	17,149	16,172	14,250	16,458	21,526	20,296	16,762
Total furnace	127,818	120,406	127,448	122,065	126,624	122,462	120,390	117,761	117,160	129,548	122,893
Contact types	32,222	28,717	31,552	30,460	30,613	29,011	30,120	29,782	30,144	30,972	29,621
Totals	160,040	149,123	159,000	152,525	157,237	151,473	150,510	147,543	147,304	160,520	152,514
Shipments											
Furnace types											
Thermal	11,846	11,361	11,204	10,242	10,376	8,327	8,326	10,917	12,580	13,347	12,554
SRF	32,165	26,973	27,492	25,239	26,646	19,893	20,242	22,109	25,682	33,329	19,103
HMF	9,453	8,420	9,051	9,184	8,068	8,483	7,519	8,195	8,987	11,821	8,328
FEF	19,381	16,379	17,559	18,369	17,413	15,054	14,311	16,340	18,576	20,770	14,784
HAF	36,934	35,142	36,374	31,287	37,319	32,698	33,799	34,502	35,328	43,819	29,052
SAF, ISAF	14,500	14,762	15,637	15,015	14,517	13,055	13,610	13,962	15,366	16,483	11,242
Total furnace	124,279	113,037	117,317	109,336	114,339	97,510	97,807	106,025	116,519	139,569	95,063
Contact types	33,256	31,548	30,377	31,032	31,582	29,609	28,661	32,500	35,352	36,807	25,444
Totals	157,535	144,585	147,694	140,368	145,921	127,119	126,468	138,525	151,871	176,376	120,507
Producers' Stocks, End of Period											
Furnace types											
Thermal	6,013	6,130	7,053	7,476	8,812	11,968	15,219	16,715	16,062	16,249	16,689
SRF	21,021	24,415	28,615	32,087	37,063	46,251	56,869	64,264	67,689	64,365	72,334
HMF	21,304	21,565	20,498	20,078	20,982	20,565	20,525	20,767	20,174	16,981	19,264
FEF	24,957	28,096	31,896	33,475	34,401	39,465	43,044	41,974	38,393	33,944	35,043
HAF	36,323	37,988	39,672	42,217	43,728	48,572	53,107	54,284	50,167	47,112	57,631
SAF, ISAF	26,669	25,462	26,053	31,133	33,815	36,932	37,572	40,068	46,228	50,041	55,561
Total furnace	136,287	143,656	153,787	166,516	178,801	203,753	226,336	238,072	238,713	228,692	256,522
Contact types	95,294	92,463	93,638	93,066	92,097	91,499	92,958	90,240	85,032	79,197	83,374
Totals	231,581	236,119	247,425	259,582	270,898	295,252	319,294	328,312	323,745	307,889	339,896
Exports											
Furnace types	21,806	24,725	24,105	17,295	19,647	22,922	17,545	18,630	21,529	25,295	.....
Contact types	11,886	15,097	12,607	14,957	12,189	14,662	12,767	16,773	16,491	18,930	.....
Totals	33,692	39,822	36,712	32,252	31,836	37,584	30,312	35,403	38,020	44,225	.....

Source: Bureau of Mines, United States Department of the Interior, Washington, D. C.

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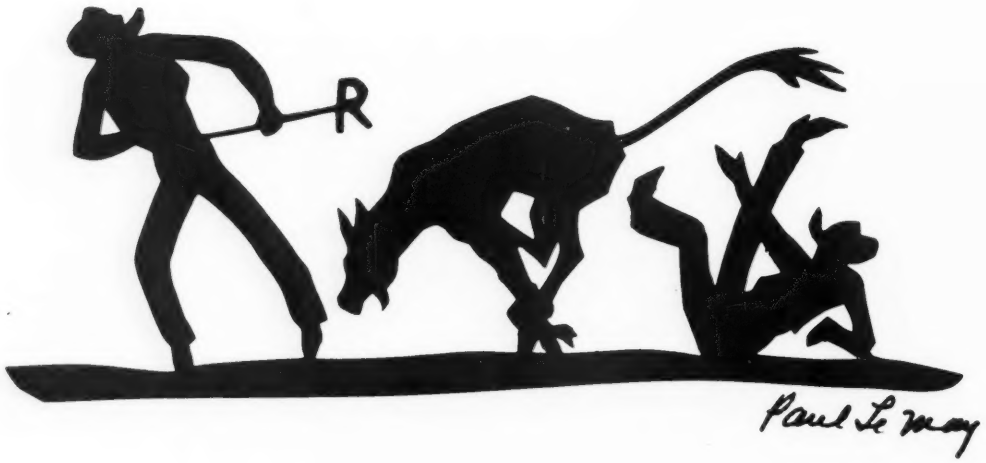
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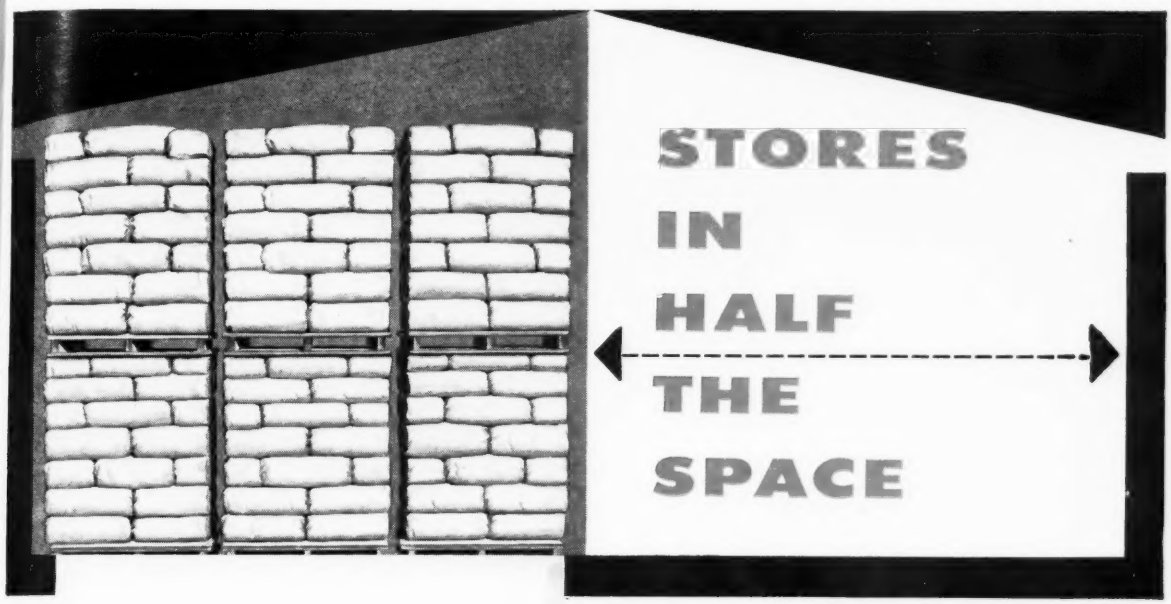
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